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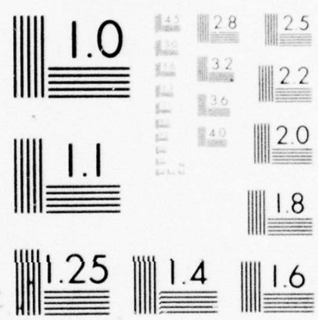

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RADC-TR-76-302, Volume III (of three)
Final Technical Report
October 1976

ATEC DIGITAL ADAPTATION STUDY
Summary and Recommendations

Honeywell Inc

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ROME AIR DEVELOPMENT CENTER
AIR FORCE SYSTEMS COMMAND
GRIFFISS AIR FORCE BASE, NEW YORK 13441

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Performance Assessment, Fault Isolation, and Trend Analysis (PA/FI/TA) in Digital Transmission Systems.
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The *ATEC Digital Adaptation Study sought to answer the questions: (1) What should be monitored for PA/FI/TA of the FKV system; (2) What measurements, data collection, and analysis should a monitor system perform, (3) Is the ATEC system and equipments applicable in satisfying the measurement and analysis requirements, either unmodified or with minor adaptations, and (4) Can an ATEC/FKV demonstration be performed: The study addressed each of these questions in turn, and the answer is that the ATEC system and equipments, augmented by minor hardware and software adaptations, can satisfy all the

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PA/FI/TA monitoring system requirements for the FKV digital transmission system. An ATEC monitoring system for the entire FKV system is presented and operational characteristics dealing with all aspects of the monitoring system are presented. In addition, an ATEC/FKV demonstration configuration is presented which would enable the validation of the ATEC digital transmission system monitoring capability through field testing and data collection on a link within the FKV system.

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TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (CONTINUED)

LIST OF TABLES

Section 1

INTRODUCTION AND SUMMARY

The ATEC Digital Adaptation study objectives were: 1) Analyze the FKV digital transmission system and identify those system and equipment monitor points which contribute to Performance Assessment (PA), Fault Isolation (FI), and Trend Analysis (TA) of the digital transmission system, 2) determine the monitoring system requirements which permit monitor point data collection and analysis, 3) study and analyze the ATEC system and equipment applicability in satisfying the measurement and analysis requirements for PA/FI/TA, and 4) recommend ATEC hardware and software adaptations, as required, to permit a demonstration of ATEC's digital transmission system monitoring capability in the FKV system.

Volume I of this report presents the results of the study and analysis which was performed to determine the FKV system monitor points which would enable PA/FI/TA of that digital transmission system. The recommended monitor point lists for each of the FKV system equipments are shown in Tables 1-1 through 1-7. Volume I also addresses the monitoring system considerations and requirements for PA/FI/TA of the FKV system. Details and rationale appear in Paragraphs 2.3 and 2.4 of Volume I.

Volume II of this report presents the results of the ATEC system and equipment applicability study. This portion of the study addressed the usefulness of ATEC, both unmodified and with minor adaptations, to satisfy the monitor point measurement, data collection, and analysis resulting from the FKV system and equipment analysis for PA/FI/TA.

A summary of the ATEC equipment applicability is given in Table 1-8.

It should be noted that while the nucleus subsystem is shown as being applicable with minor adaptations for monitoring the FKV system, it is not recommended for two reasons. First, the concept of nodal monitoring as discussed in Paragraph 2.4 of Volume I, and in keeping with this approach, the PATE is better suited for use as the nodal processor. Second, since a demonstration of the proposed ATEC system in the FKV system is planned, it is not logistically practical to propose that the nucleus subsystem be used in the FKV network during the same timeframe it is undergoing testing in the ATEC JOT&E.

The ATEC applicability study identified the need for four hardware adaptations along with software adaptations to the PATE in order to satisfy the digital transmission system monitoring system requirements. The recommended ATEC adaptations are listed in Table 1-9.

Volume III of this report presents a summary of the study by application of the ATEC system and requirements to PA/FI/TA of the FKV system. It also recommends an ATEC/FKV demonstration configuration which would enable the ATEC digital transmission system monitoring approach to be field tested and operational data, addressing all aspects of the monitoring system, to be collected.

TABLE 1-1. RECOMMENDED AN/FRC-162 RADIO MONITOR POINTS

T_x Problem Tx A Tx B	Definition: T_x Problem is the OR function of Power, AFC, and Pilot alarms. Alarm Condition: Occurs if transmitter RF power is below a specified threshold, if AFC voltage is beyond normal control range or phaselock reference is lost, or if pilot level is below a specified threshold. Use: To determine whether or not A or B transmitter is operative or in a degraded or inoperative state.
R_x Problem Rx A Rx B	Definition: R_x Problem is the OR function of R_x Phaselock and R_x Squelch alarms. Alarm Condition: Occurs if receiver local oscillator has lost phase-lock with receiver crystal controlled reference or if received signal level is below a preset threshold. Use: Employed to indicate if received signal is in a usable or degraded state. It also can be used for fault isolation since joint occurrence of a T_x Problem and R_x Problem indicates a T_x failure while no T_x Problem and an R_x Problem indicates an RF path or R_x failure.
R_x Squelch Rx A Rx B	Definition: R_x Squelch is the radio receiver squelch alarm output. Alarm Condition: Indicates that received signal level is below a preset threshold. Use: Employed to indicate severe path loss or a degraded signal level caused by T_x or R_x degradation.

TABLE 1-1. RECOMMENDED AN/FRC-162 RADIO MONITOR POINTS (Cont'd.)

Note: Both R_x Squelch and R_x Problem (which includes R_x Squelch) are useful alarms. R_x Squelch is monitored and correlated with the T1-4000 BER measurement to indicate a high error rate due to RF fade. Occurrence of R_x Problem indicates that no signal is present in the radio receiver or that the signal is below a usable level. Joint occurrence of both R_x Problem alarms indicates a failure of both radio channels and, hence, loss of RF communications.

Maintenance Maintenance A Maintenance B	Definition: This alarm or status indicator indicates that maintenance is in progress on a particular radio equipment. Alarm Condition: Controlled by position of toggle switches located near equipment. Use: If maintenance is known to be in progress on equipment, this knowledge is used to suppress monitoring system response to maintenance-related alarms.
RSL Rx A Rx B	Definition: RSL A and B are receiver analog output voltages which are monotonic functions of respective receiver received signal levels. Alarm Condition: Does not apply to these analog output voltages. Use: RSL is processed by monitoring system to yield value of received signal level. RSL provides path loss information as well as information related to T_x and R_x performance.
R_x Pilot Rx A Rx B	Definition: R_x Pilot is the radio receiver pilot alarm output. Alarm Condition: Indicates loss of radio pilot carrier in radio receiver. Use: Loss of pilot monitor means loss of a usable radio signal. Both A and B Pilot alarms are ANDed to yield SSFSS Radio R_x alarm. Occurrence of Radio R_x alarm indicates loss of both radio channels.

TABLE 1-1. RECOMMENDED AN/FRC-162 RADIO MONITOR POINTS (Cont'd.)

<u>T_X In-Service</u> (Unit A or B)	Definition: T_X In-Service is a two-valued status indicator which indicates which of two radio transmitters on a particular link is in-service. Alarm Condition: Monitor point employed to indicate status rather than alarm condition. Use: To determine which transmitter is in operation, mainly for use in fault isolation.
<u>R_X In-Service</u> (Unit A or B)	Definition: R_X In-Service is a two-valued status indicator which indicates which of two radio receivers on a particular link is in-service. Alarm Condition: Monitor point employed to indicate status rather than alarm condition. Use: To determine which receiver is in operation. Long term use of one receiver under conditions of automatic switching may indicate that the receiver that is rarely used is degraded when compared to the high use receiver.
<u>Power Supply Voltages 1-8</u>	Definitions: These are actual values of radio internal voltages. Alarm Condition: This does not apply to analog parameters. Use: For determining power supply degradation before power supply and consequential equipment failure.

TABLE 1-2. RECOMMENDED BASEBAND MONITOR POINTS

Radio Baseband Eye Rx A Rx B (Noise, Amplitude, and Bursts)	Definition: Noise is the eye pattern scatter measured on three level partial response signal as measured at baseband radio output between radio receiver and T1-4000 receiver input. Amplitude is the signal level of the partial response before AGC circuit. Bursts are a measure of the burst-like nature of noise in the three-level eye. Alarm Condition: This does not apply to these analog parameters. Use: Parameters measured here are derived from the baseband signal at the radio receiver outputs. These are analog signals from radio receiver outputs to the diversity switch to the T1-4000 receiver input. Briefly, the baseband waveform is AGCd and filtered to produce a 3-level partial response signal. Measures of the nonAGCd level, composite signal eye scatter or noise and the burst character of the noise are converted to analog voltages which are measured by a MAC. Eye scatter noise is related to multiplexer performance over a BER range of 10^{-4} to 10^{-12} and is used to derive a measure of radio link performance margin. Amplitude of the signal from the radio output is valuable for assessing operation of the multiplexer transmitter and radio link and also is useful for fault isolating to the level of the T1-4000 receiver. Monitoring of baseband eye pattern at T1-4000 radio interface allows a comparison of derived BER performance, at the radio baseband, with the calculated BER from T1-4000 frame error rate. This permits degradation or fault isolation to the analog signal processing portion of the T1-4000. (This includes 3LPR filter and AGC circuits prior to the redigitizing process in the T1-4000 receiver.)

TABLE 1-2. RECOMMENDED BASEBAND MONITOR POINTS (Cont'd.)

	A measure of the burstlike or hit nature of the noise is also made for the purpose of detecting radio frequency interference of an impulse or burst nature. Inclusion of the burst measurement in the baseband monitor effectively removes the requirement for a radio noise burst measurement.

TABLE 1-3. RECOMMENDED T1-4000 MONITOR POINTS

Switch Major	Definition: Major alarm output of the switch which controls two T1-4000s. Alarm Condition: Occurs if a transfer from use of one T1-4000 to other T1-4000 fails, if standby multiplexer loses synchronization while transferred, if a remote alarm is received, or in case of a switch or multiplexer power failure. Use: Primarily to indicate a switch failure or failure of a transfer of operation from one T1-4000 to other T1-4000.
Switch Minor	Definition: This is the minor alarm output of the switch which controls two T1-4000s. Alarm Condition: Occurs if operation of receiver or transmitter is transferred, if a receiver or transmitter automatic transfer is disabled, if a unit loses power, or if the standby multiplexer loses synchronization. Use: Primarily to indicate transfer of operation of a multiplexer receiver or transmitter.
Major Alarm Unit A Unit B	Definition: This is the major alarm output of each of two T1-4000s which are served by a switch. Alarm Condition: Occurs if the three-level error density exceeds a 10^{-5} threshold, if 20V dc power is lost, if a remote alarm is received, or if main frame or control reframe synchronization is lost in receiver. Use: To indicate failure of a receiver or loss of control or main frame synchronization in a receiver.

TABLE 1-3. RECOMMENDED T1-4000 MONITOR POINTS (Cont'd.)

Maintenance Unit A Unit B	Definition: This alarm or status indicator indicates that maintenance is in progress on a particular T1-4000 multiplexer. Alarm Condition: Controlled by position of a toggle switch located near respective equipment. Use: If maintenance is known to be in progress on an equipment, this knowledge is used to suppress monitoring system response to maintenance-related alarms.
Main Frame Bit Error Unit A Unit B	Definition: A pulse is generated when the receiver detects an incorrect framing bit. Alarm Condition: This is a monitored system parameter rather than an alarm. Use: Main frame bit error pulses are be counted to yield a bit error rate value for T1-4000/Radio path.
Control Reframe Unit A Unit B	Definition: This is an indication given when the receiver undergoes the process of control reframe. Alarm Condition: This is a monitored system parameter rather than an alarm. Use: Latched to provide a measure of multiplexer performance by detecting the occurrance of a control reframe.
T_X In Service and R_X in Service (Unit A or B)	Definition: These are two-valued status indicators which indicate which of two multiplexer transmitters and which of two multiplexer receivers is in operation at a given time. Alarm Condition: An alarm condition does not apply to this status indicator. Use: Knowledge of which unit is typically in service is used to locate degraded in-service or standby units and to fault isolate.

TABLE 1-3. RECOMMENDED T1-4000 MONITOR POINTS (Cont'd.)

Power Supply Voltage 1-5	Definition: These are the actual values of the multiplexer internal power supply voltages. Alarm Condition: This does not apply to these analog parameters. Use: Useful for determining power supply degradation before power supply and consequential equipment failure.

TABLE 1-4. RECOMMENDED T1WB1 MONITOR POINTS

Office	Definition: This is an alarm provided by T1WB1. Alarm Condition: An office alarm is given due to remote alarm, local alarm, bi-polar errors in the receiver, fuse alarm, loop alarm, outgoing alarm cut-off switch or loss of power. A uniform error rate of 2.6 x 10^{-5} will trigger alarm within 100 msec. Use: Primarily to indicate a loss of power or an abnormally high bi-polar error violation.
Reframe	Definition: This signal indicates that the multiplexer is attempting to acquire frame synchronization. Alarm Condition and Use: Indicates that multiplexer does not have frame synchronization. Use: Latched to provide a measure of multiplexer performance by detecting the occurrance of a reframe.
Maintenance	Definition: This maintenance signal indicates that a maintenance function is in progress on the T1WB1. Alarm Condition: Controlled by position of a toggle switch near the multiplexer location. Use: If maintenance is known to be in progress on the equipment, this knowledge is used to suppress monitoring system response to maintenance-related alarms.
Frame Bit Error	Definition: This is a pulse which indicates the presence of a frame bit error in the receiver. Alarm Condition: This is a monitored system parameter rather than an alarm. Use: Frame bit errors are counted to yield a bit error rate value for the respective T1WB1/T1-4000/Radio paths in the FKV.

TABLE 1-4. RECOMMENDED T1WB1 MONITOR POINTS (Cont'd.)

<u>Power Supply Voltages 1-6</u>	Definition: These are the actual values of the T1WB1 multiplexer internal power supply voltages. Alarm Condition: This does not apply to the analog power supply voltages. Use: To determine power supply degradation before power supply and consequential equipment failure.

TABLE 1-5. RECOMMENDED CY-104 MONITOR POINTS

Service	Definition: A composite alarm that indicates when any of the following conditions exist: local alarm, loop alarm, or remote alarm. Alarm Condition: Alarm is activated if any of the above occur. Use: For CY-104 fault isolation. If no alarms at the T1-4000 and radio level in the system and a service alarm is activated, failure of a CY-104 is indicated.
Remote	Definition and Alarm Condition: This alarm is activated if the far end CY-104 is not passing valid data. Use: This alarm serves the same use as the Service Alarm. It also serves as a redundant back-up alarm since it is available at a different physical location than the corresponding CY-104 Service Alarm.

TABLE 1-6. RECOMMENDED VF MONITOR POINTS

IQCS MEASUREMENTS

Average Power (dBm)	Definition: This is the average power level observed over a 3-second interval on the VF channel undergoing analysis. Alarm Condition: Alarm condition does not apply to this analog measurement. Use: If no data or voice signal is present, this measurement yields a value for residual system or background noise. If data or voice is present, the measurement yields a value of the average signal level.
Signal to Noise (2600 Hz)	Definition: This is the noise observed on the VF channel after notching out the 2600 Hz tone. Alarm Condition: Alarm condition does not apply to this analog measurement. Use: Yields a SNR for the channel by dividing the total power observed by the notched noise power.

TABLE 1-7. RECOMMENDED SITE MONITOR POINTS

	HDG	SWN	KSL	STB	SGT	VHN
Illegal Entry		X		X		
Fire: Generator		X		X		
Fire: Building		X		X		
Water Flood		X		X		
Fuel Level		X		X		
DC/AC Inverter			X		X	
Wave Guide Pressure	X	X	X	X	X	X
Wave Guide Humidity	X	X	X	X	X	X
Tower Lights		X	X	X		X
AC Power	X	X	X	X	X	X
Battery Charger	X	X	X	X	X	X
Battery Status	X	X	X	X	X	X

Definition: The site monitor points are defined in the table above.

Alarm Conditions: The alarm conditions are given if the defined variables above occur, decrease below a specified value or if the defined events do not occur.

Use: Justification as to the usefulness is based upon selection of the site monitor points in the reference below:

"System Engineering Plan, FKV Project" - Volume I, prepared by Raytheon-Europe Electronics System Agency, August 1974.

TABLE 1-8. SUMMARIZED ATEC APPLICABILITY FOR DIGITAL SYSTEM MONITORING

ATEC EQUIPMENT	APPLICABLE WITHOUT MODIFICATION	APPLICABLE WITH ADAPTATIONS	NOT APPLICABLE
NSS CONSOLE	OPERATOR INTERACTION		
NSS CENTRAL PROCESSOR & DATA CONCENTRATOR	TELEMETRY		
NSS SOFTWARE		DATA PROCESSING	
* PATE SOFTWARE		DATA PROCESSING	
PATE *IQCS, I/OQCS, DDMS	VF QUALITY, LOW SPEED DATA	50Kbps DATA (T1WB1)	
* PATE CRT & PRINTER	OPERATOR INTERACTION		
* PATE LINE INTERFACE	TELEMETRY		
* ANALOG SCANNER	VF QUALITY DC VOLTS	EVENT COUNTER EVENT LATCH	
TSS	VF QUALITY		
MSMS	VFCT QUALITY		
* MAD	ALARM		
* AS	ALARM		
* AD	ALARM		
* MAC	VF QUALITY DC VOLTS EVENT COUNTER EVENT LATCH		
* BBM	BASEBAND ACTIVITY	BASEBAND EYE MONITOR	
SLG	BASEBAND LOOPBACK		
NSF		BASEBAND QUALITY	
RPS	WAVEGUIDE REFLECTIONS		
NLG			N/A
PM			N/A
V/DC	TELEMETRY		
ILSC	VF QUALITY		
BBSA			N/A

* Recommended for the ATEC/FKV Demonstration

TABLE 1-9 RECOMMENDED ATEC ADAPTATIONS

Baseband Monitor (Eye Pattern Monitor)	Use: Determine radio baseband eye pattern noise, amplitude and burst noise. Purpose: Determine eye margin and an estimate of BER.
Event Per Unit Time Monitor (In Analog Scanner)	Use: Count Events and Latch Transients. Purpose: Collect framing error rates in T1-4000 and T1WB1 receiver and latch transients such as squelch, T1-4000 control reframe and T1WB1 reframe.
Voice/Data Combiner Telemetry Error Control*	Use: Detect telemetry errors. Purpose: Provide a measure of telemetry channel BER and permit bad data to be ignored by monitor system.
Remote Control Latch* (Analog Scanner)	Use: Remotely control position of latches or switches. Purpose: Control radio transmitter and recover switchover. Control T1-4000 transmitter and receiver switchover.
PATE Software Adaptations	Use: Adapt PATE for FKV use. Purpose: Provide operator interaction, control commands, control scan hierarchy and nodal monitor commands.

*Not required for ATEC/FKV Demonstration. The V/D Combiner Telemetry Error Control is not required since only one remote monitor site is employed in the demonstration. The remote control latch is not justified in the demonstration on the basis of the necessary FKV hardware modifications which would have to be performed in order to permit control by the monitoring system hardware. Moreover, the desirability of these two adaptations can be adequately justified by logical analysis as well as hardware demonstration.

Section 2

ATEC IN THE FKV SYSTEM

2.1 INTRODUCTION

The following section summarizes the technical conclusion made as a consequence of the digital ATEC adaptation study applied to the entire FKV digital network. Specifically, system diagrams of the FKV which include all selected monitor points are presented, the physical layout of all monitoring equipment is shown, the required telemetry scheme is discussed and the monitoring system performance in terms of scanning sequence and reaction times is detailed.

2.2 FKV SYSTEM DIAGRAM

The FKV is a communication system which includes sites at Hiedelberg (HDG), Schwetzingen (SWN), Koenigstuhl (KSL), Stocksberg (STB), Stuttgart (SGT) and Vaihingen (VHN). Analog VF users interface with the system by means of CY-104s which consist of a PCM voice digitizer, a TDM which multiplexes 24 voice channels and a KG-34 encryption device. Digital users up to 50 Kbps interface through a T1WB1 asynchronous multiplexer. High level multiplexing is accomplished by the T1-4000 which is capable of asynchronously multiplexing eight 1.544 Mbps data streams.

The T1-4000 output, consisting of a 12.6 Mbps data stream encoded in analog form as a three level partial response signal is transferred between sites by means of AN/FRC-162 FM radios.

Both the T1-4000 multiplexers and AN/FRC-162 radios are fully redundant with automatic switchover. Space diversity is employed in the radio path for fade protection.

A system diagram showing all site configurations and user breakouts is given in Figure 2-1. Note that SWN and STB are simply repeater sites and may potentially be unmanned.

2.3 FKV SYSTEM MONITOR POINTS

Monitor points in the FKV have been classified according to usage and type.

FIGURE 2-1 LOCATED AT END OF VOLUME III

Major alarms (MA), are those alarms which if observed indicate a loss of service. Alarms (A), are those alarms which indicate loss of redundant equipment or equipment operation in a degraded mode.

Status indicators (S), are two state, digital indicators which show which unit of redundant equipment is operational, or the fact that maintenance is in progress on an equipment. They are scanned by an alarm scanner in a manner identical to scanning of alarms. However, software processing differs because they indicate system or equipment condition as opposed to an alarm condition.

Parameters employed for PA/TA/FI have been classified as analog (AP) or digital (DP) although in the proposed monitoring system implementation both are in the form of analog voltages when sampled by the ATEC Measurement Acquisition and Control group (MAC).

Analog parameters which are employed for preventive maintenance activity (AP/M) are distinguished from the remaining parameters since maintenance related parameters can be scanned at a slower rate.

Parameter type classification for the parameters monitored in the FKV is summarized in Table 2-1.

A summary of all FKV monitor points as a function of physical location is given in Figures 2-2 through 2-7.

All alarms are monitored by means of alarm scanners while performance and maintenance related analog and digital parameters are monitored by means of analog scanners. Usually status indicators are monitored by means of alarm scanners. In the situation in which an additional alarm scanner would be required to pick up status indicators, these indicators are picked up by means of available analog scanner inputs. Some monitor points are listed under both alarm and analog scanners. These are not redundant since input to the latter is required for latching purposes.

2.4 MONITORING EQUIPMENT AND TELEMETRY CONFIGURATION

ATEC equipment elements as a function of FKV site are diagrammed in Figure 2-8. Also shown are the telemetry channels necessary to interconnect the equipment.

TABLE 2-1. FKV MONITOR POINT CLASSIFICATION

MAJOR ALARMS

*Radio Rx (AN/FRC-162)
Switch Major (T1-4000)
Office (T1WB1)
Service (CY-104)

STATUS

Maintenance A (AN/FRC-162)
Maintenance B (AN/FRC-162)
Maintenance NORM (T1-4000)
Maintenance STBY (T1-4000)
Maintenance (T1WB1)
Rx In Service (AN/FRC-162)
Tx In Service (AN/FRC-162)
Rx In Service (T1-4000)
Tx In Service (T1-4000)

ANALOG AND DIGITAL PARAMETERS

Received Signal Level A&B (AN/FRC-162)
3-Level Partial Response Eye (Radio Baseband A&B)
- Noise
- Amplitude
- Noise Bursts

Main Frame Bit Errors NORM (T1-4000)
Main Frame Bit Errors STBY (T1-4000)
Control Reframe NORM (T1-4000)
Control Reframe STDY (T1-4000)
Frame Bit Errors (T1WB1)
Reframe (T1WB1)
Receive Squelch (AN/FRC-162)

ALARMS

Rx Squelch A&B (AN/FRC-162)
Rx Problem A&B (AN/FRC-162)
Tx Problem A&B (AN/FRC-162)
Major NORM (T1-4000)
Major STBY (T1-4000)
Switch Minor (T1-4000)
Remote (CY-104)

Site:
- Illegal Entry
- Fire: Generator
- Fire: Building
- Water Flood
- Fuel Level
- DC/AC Inverter
- Wave Guide Pressure
- Wave Guide Humidity
- Tower Lights
- AC Power
- Battery Charger
- Battery Status

ANALOG PARAMETERS/MAINTENANCE

DC Power Supply Voltages (All)

VF PARAMETERS

IQCS Measurements:
- Average Power (dBm)
- Signal To Noise (2600 Hz)

*Radio Rx = (Rx A Pilot)●(Rx B Pilot)

FIGURES 2-2 THROUGH 2-7 LOCATED AT END OF VOLUME III

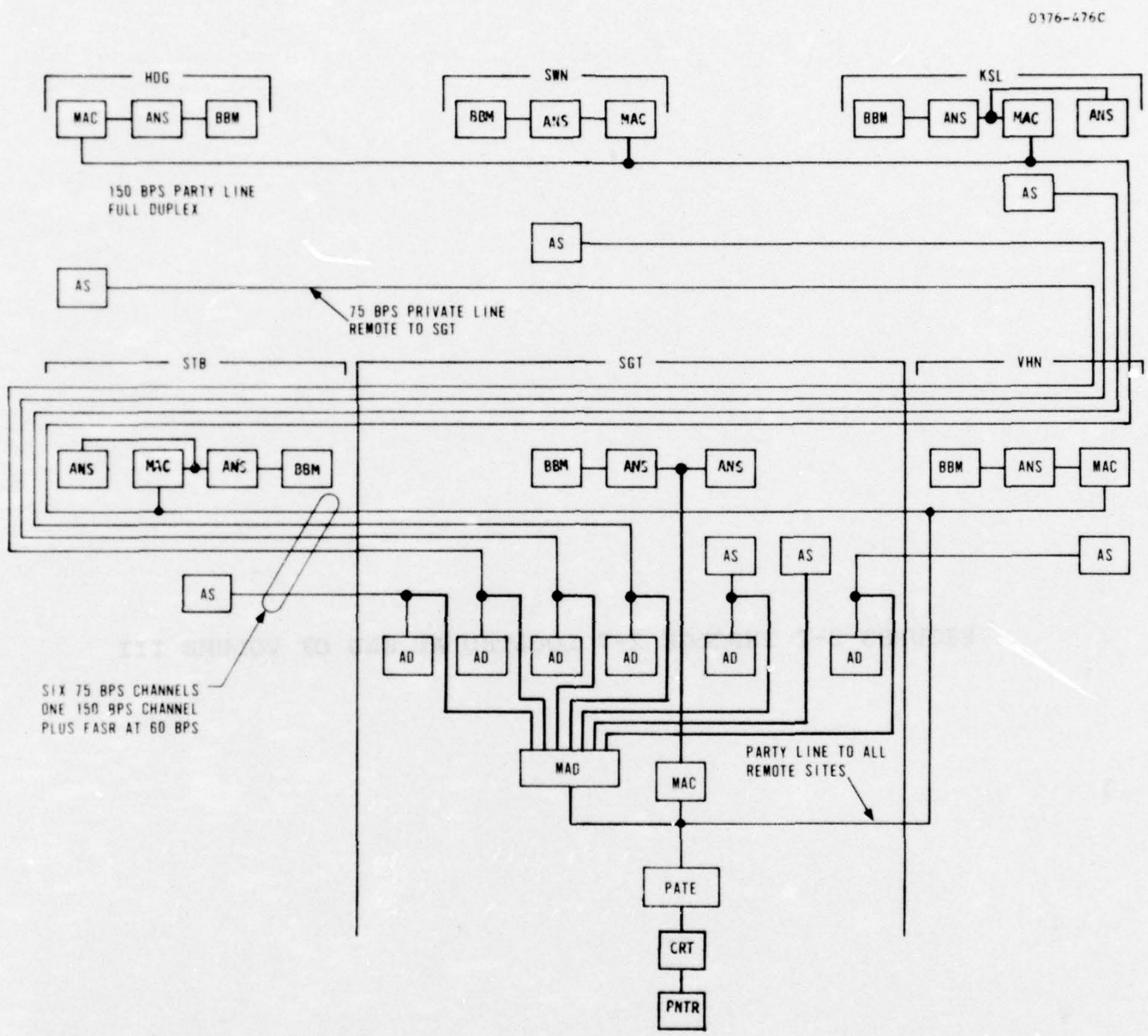


FIGURE 2-8. EQUIPMENT/TELEMETRY CONFIGURATION

Each site requires at least one alarm scanner (AS), measurement acquisition and control group (MAC), analog scanner (ANS) and baseband monitor (BBM).

Alarm scanners relay the status of up to 50 alarms or binary signals from the scanner location to remote or local alarm displays (AD) or master alarm displays. One AS may scan up to 50 alarms and require approximately 10 seconds to convey the status of 50 alarms to the AD or MAD at an output data rate of 75 bps.

A MAC serves to sample and transmit the value of analog voltages to a remote processor or the monitoring system control center. In this mode of operation in which a series of analog voltages are scanned in sequence, approximately 2.5 seconds are required for each analog measurement.

The ANS serves as the interface between the MAC and numerous analog input signals and it is the unit which physically selects which analog signal is measured by the MAC. One ANS may switch up to 100 analog voltages.

An events per unit time counter (EPUT) is employed at each site and is housed in an analog scanner. The EPUT consists of a single clock card and one counter card for each series of events being counted. For example, at HDG to count T1-4000 main frame bit errors on the normal and standby units and T1WB1 frame bit errors requires three counter cards and one clock card. Briefly, the EPUT is capable of counting events over a programmable time interval (Range) and then holding the resultant count until polled. Simultaneously, the EPUT monitors two valued variables and sets a latch if the variable changes state. For xample, if while counting main frame bit errors, the radio Rx In Service changes state, this occurrence is recorded by means of an EPUT latch since this occurrence impacts the recorded error count interpretation.

Eye pattern noise, amplitude and burst noise are measured by the BBM and converted into the corresponding analog voltages for subsequent measurement by the MAC. These measurements detect RF path, radio, and T1-4000 transmitter degradations before a high BER is observed by the T1-4000 frame bit error measurements and long before the system is rendered unusable. They assist in T1-4000 fault isolation by means of examining the eye pattern at a point between the radio receiver and the T1-4000 receiver.

The five remote sites are connected to the central site, SGT, by the telemetry system. This system employs one 75 bps, private line channel for each remote alarm scanner and a common, party line, 150 bps channel to all MAC/MADs in the system.

At SGT those alarm scanners (ASs) working as part of the sudden service failure sensing system are connected to alarm displays (ADs) which present the status of loss of service alarms throughout the system.

All alarm scanners are connected to a master alarm display (MAD) which enables the system processor to read alarm status or poll for the status of selected major alarms.

A single 150 bps party line serves as the final interface between all monitoring equipment and the central processor or programmable ATEC terminal element (PATE). FKV system status may be displayed on a CRT in addition to the alarm displays previously mentioned.

FKV sites are connected by two radio orderwires. A baseband, 0-4 kHz, channel may be employed for voice communication while a 4 to 8 kHz channel is available for telemetry. An installed fault alarm status reporting system (FASR) utilizes FSK signalling from SWN to HDG and KSL at a 5 kHz center frequency and from STB to KSL and STG at a 7 kHz center frequency. Hence, depending upon the physical location in the FKV, frequency bands about these center frequencies may or may not be available for additional telemetry.

Telemetry bandwidth used from SGT to remote sites is illustrated in Figure 2-9. All remote MACs share a 150 bps party line centered at 6020 Hz.

Telemetry from remote sites to SGT is diagrammed in Figure 2-10. The individual 75 bps private lines are from the remote ASs to the ADs at SGT and the 150 bps channel interconnects all MACs. Frequency bands were selected so as not to interfere with the SWN to KSL, 5 kHz, FASR channel. Empty frequency bands have been included between the 75 bps channel to permit possible future expansion of the system to include individual 150 bps private lines from remote site MACs to SGT if desired.

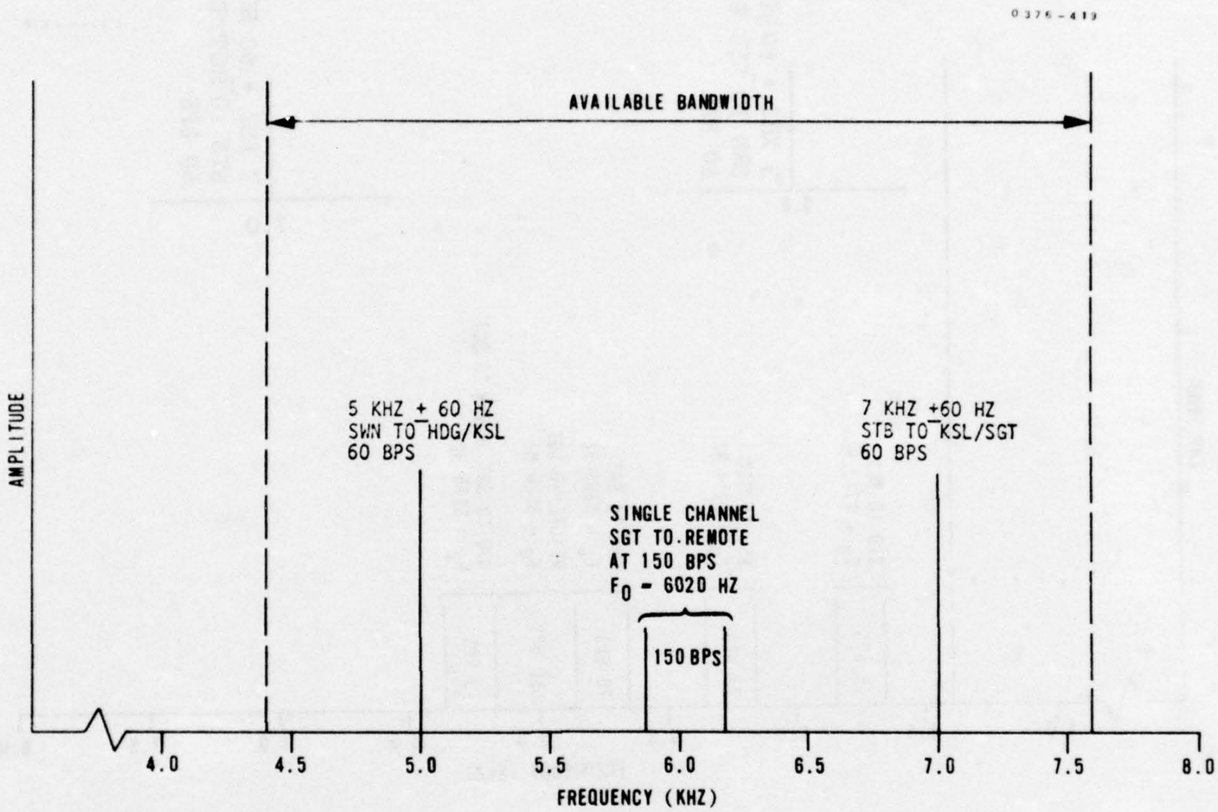


FIGURE 2-9. TELEMETRY - SGT TO REMOTE SITES

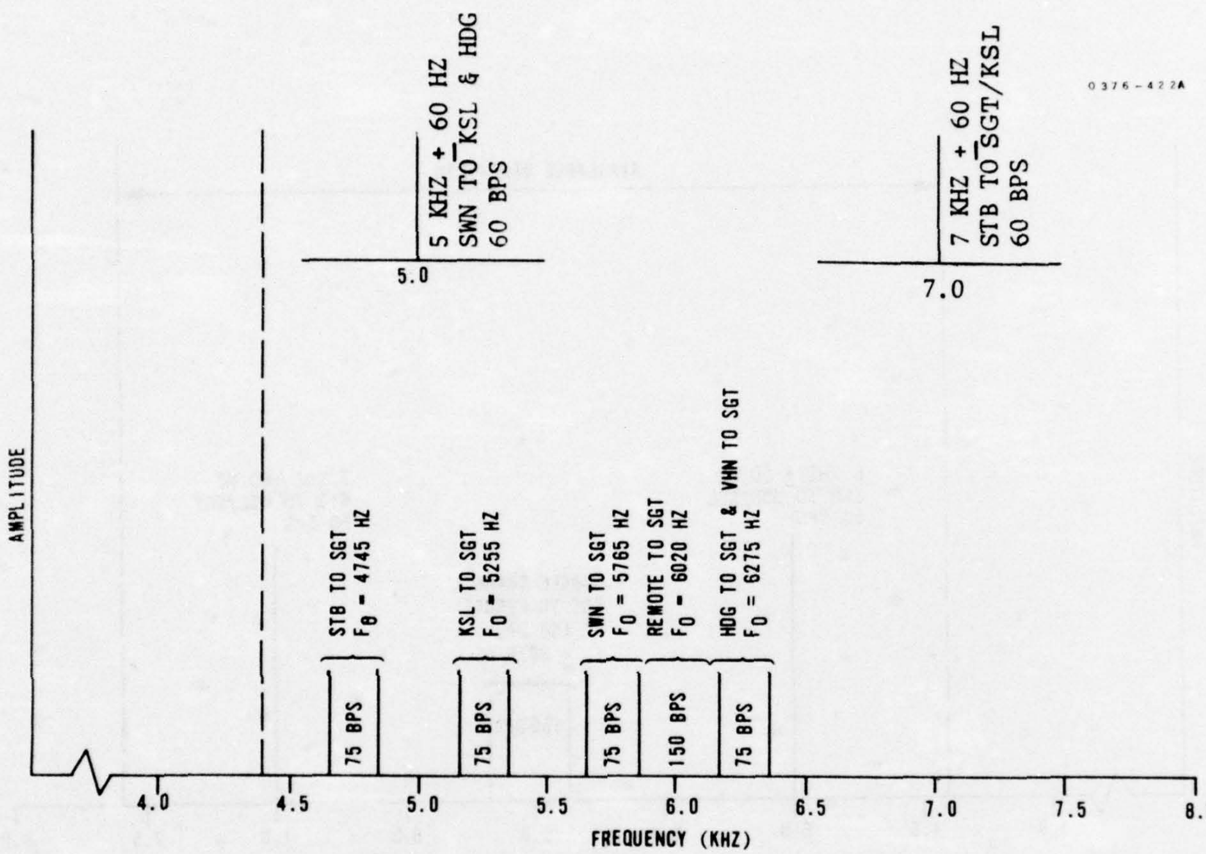


FIGURE 2-10. TELEMETRY - REMOTE SITES TO SGT

2.5 FKV SYSTEM SCAN SUMMARY

Discussion and analysis presented in Paragraph 2.1.1 of Volume II, show that the time required for the PATE (via the AS) to command the scanning of and retrieve the status of 40 alarms is 8.2 seconds. The time required to retrieve the status of 50 alarms in a single alarm scanner is 10.0 seconds. Also shown is that 2.5 seconds is required to measure and retrieve an analog voltage.

Scanning the status of 40 alarms requires 8.2 seconds, scanning 50 alarms requires 10.0 seconds, and measuring an analog voltage requires 2.5 seconds, therefore, the time to scan all parameters of a given classification at each FKV site may be computed. These site scan time requirements are summarized in Table 2-2. Note that the alarm scan times for 34, 35, and 40 alarms are identical since the AS is incremented in units of 10 alarms.

Given the absolute time required to scan all parameters of a particular type throughout the system and the frequency with which these parameters may be scanned, the fraction of time required in relation to total time available may be computed. For example, if scanning of all analog power supply voltages requires 360 seconds total and all voltages are scanned four times per day, a total of 1,440 seconds per day is required. This is equivalent to 60 seconds/hour, 1 second/minute, or 0.5 second/30 seconds. Likewise, all other FKV scan times may be normalized to a 30 second base since 30 seconds is the least common denominator of all scan times.

Since the absolute time to scan all parameters or alarms at a particular site is fixed by hardware design, the scan frequency for monitor points must be selected such that the total time required to scan the system does not exceed the total time available. The scan frequency cycle times presented in Table 2-3 represent reasonable, although subjective, choices for scan rates. Moreover, the table shows that for the selected rates, 29.65 seconds out of a 30 second interval (or 99 percent of the available time for scanning) is required.

In summary, all alarms are scanned every three minutes, all analog and digital parameters every fifteen minutes, and all status parameters at least every five minutes. (The status parameters at all sites, except SGT, are scanned by the same alarm scanner as the alarms, since the scanners at these sites are not fully loaded. At SGT, where an additional special alarm scanner is required for status parameters, the

TABLE 2-2. SITE SCAN TIME REQUIREMENTS

SITE	MAJOR ALARM		ALARM		STATUS		ANALOG & DIGITAL PARAMETERS		ANALOG PARAMETERS MAINTENANCE	
	Number	Time	Number	Time	Number	Time	Number	Time	Number	Time
HDG	1AS●	0.3S	35	8.2S	*	*	18	45S	19	47.5S
SWN	1AS●	0.3S	34	8.2S	*	*	22	55S	16	40S
KSL	1AS●	0.3S	50	10.0S	*	*	32	80S	26	65S
STB	1AS●	0.3S	50	10.0S	*	*	32	80S	26	65S
SGT	2AS●	0.6S	50	10.0S	23	6.5S	36	90S	38	95S
VHN	1AS●	0.3S	40	8.2S	*	*	18	45S	19	47.5S

● One Alarm Scanner at all sites except SGT.

* These status parameters are scanned by the normal alarm scanner and are grouped with the alarms as a result.

TABLE 2-3. FKV SYSTEM SCAN ANALYSIS

Parameter Type	Scan Cycle Time: Number of Times Per Day/(Cycle)	Site	Absolute Scan Time/ Cycle	Absolute Time/Cycle: Normalized to 30 Second Base
Alarms	480/(3 min)	HDG	8.2 s	
		SWN	8.2 s	
		KSL	10.0 s	
		STB	10.0 s	
		SGT	10.0 s	
		VHN	8.2 s	
			54.6 s total	9.1 sec
A&DP	96/(15 min)	HDG	45 s	
		SWN	55 s	
		KSL	80 s	
		STB	80 s	
		SGT	90 s	
		VHN	45 s	
			395 s total	13.17 sec
Status	288/(5 min)	SGT	6.5 s total	0.65 sec
AP/M	4/(6 hrs)	HDG	47.5 s	
		SWN	40 s	
		KSL	65 s	
		STB	65 s	
		SGT	95 s	
		VHN	47.5 s	
			360 s total	0.5 sec
Major Alarms	2880/(30 sec)	HDG	0.3 s	
		SWN	0.3 s	
		KSL	0.3 s	
		STB	0.3 s	
		SGT	0.6 s	
		VHN	0.3 s	
			2.1 s total	2.1 sec
IQCS VF Measurement	2880/(30 sec)		4.0 s total	4.0 sec
MAC Self Test	24/(1 hr)		15.0 s total	0.13 sec
Total Time Required Out of 30 Seconds				29.65 sec Total

$$\frac{\text{(Scan freq. per day) (Absolute scan time in sec)}}{\text{1440 minutes}} \div 2 = \text{Normalized time per 30 sec}$$

status parameters are scanned every five minutes.) All maintenance power supply voltages are scanned every six hours and all major alarms are scanned every 30 seconds. An in-service quality control subsystem (IQCS) test is performed on a VF channel every 30 seconds and all MAC's are self-tested every hour.

Scans are interlaced rather than performing all scans of a given parameter type at a particular time. The scan sequence is similar to a time-share operation in which each user is served for a small time period. See paragraph 2.4.3 of Volume II for a detailed discussion. For example, in a given 30 second interval, 2.1 seconds may be devoted to major alarm scans, 9.1 seconds to alarm scans, 13.2 seconds to analog and digital parameter scans, etc.

The average and maximum system reaction times are summarized in Table 2-4. Telemetry degradation based upon the detection of loss of telemetry or high parity check bit error rate by the PATE is given as 10 seconds. The average times shown in Table 2-4 are derived as in the following example. All alarms are scanned within a maximum time period of three minutes. However, the time required to detect an alarm condition of any one alarm is a random variable of from 0 to 3 minutes, depending on where the scan sequence is when the alarm occurs. The random times have a uniform probability density function of 0 to 3 minutes and a mean of 1.5 minutes.

2.6 SUDDEN SERVICE FAILURE SENSING SYSTEM CONFIGURATION

The sudden service failure sensing system (SSFSS) is an acronym devoted to that portion of the FKV performance monitoring system which immediately alerts the operator in the event of a gross failure accompanied by a loss of service within the communications system. For each equipment within the FKV the following alarms are collected:

Equipment	Alarm
AN/FRC-162 Radios	Radio Rx
T1-4000 Multiplexers	Switch Major
T1WB1 Multiplexers	Office
CY-104 PCM/TDM	Service
Site	Site

TABLE 2-4. PATE REACTION TIME

PARAMETER	TYPE	AVERAGE	MAXIMUM
Loss of Service	Major Alarm	15 Seconds	30 Seconds*
Loss of Standby	Alarm	1-1/2 Minutes	3 Minutes
Equipment Degradation	A&DP	7-1/2 Minutes	15 Minutes
Circuit Degradation	**	13 Minutes	26 Minutes
Telemetry Degradation	***	10 Seconds	10 Seconds
ATEC Equipment Degradation	Self Test	1/2 Hour	1 Hour

*SSFSS reaction time 1.8 sec. average; 3.7 sec. maximum.

**One Tx and one Rx VF channel from each FKV CY-104 is measured in a 26 minute period since a VF measurement is made by the IQCS every 30 seconds.

***Determine from parity check bits on data to PATE software average for 10 seconds.

A Radio Rx alarm is collected for each pair of in-service and standby radio receivers. The alarm is the AND function of radio receiver Pilot Alarms. This is written as Radio Rx = (Rx A Pilot) • (Rx B Pilot). Occurrence of the Radio Rx major alarm indicates that either both radio transmitters are out of service or both radio receivers are out of service and consequently, indicate that the communication system is out of service.

The T1-4000 switch major alarm indicates the inability of the normal and standby multiplexer transmitters to synchronize with the normal and standby receivers. Hence, this alarm also indicates a loss of communication system service.

The office alarm on the T1WB1 and service alarm on the CY-104 indicate loss of the related equipment and consequently loss of service to those users serviced by that multiplexer or PCM/TDM. See Volume II, page 210.

Status of the SSFSS alarms are displayed on the site related AD units at SGT. These ADs indicate the status of all alarms on the corresponding AS to which they are attached, see Figure 2-8. As configured, the mean time between the occurrence of a SSFSS alarm and a state change on the display is 1.8 seconds. Additional information on the SSFSS state change rate is contained in Volume II, Paragraphs 2.1.1.1.2 through 2.1.1.1.4.

Site alarms such as fire, water, and intrusion, those affecting system operation, are ORed together and presented as part of the SSFSS to call immediate attention to problems in these areas.

Displays related to the SSFSS for each of the six FKV sites are illustrated in Figures 2-11 through 2-16. Located at SGT, each remote or local site is represented by a site configuration diagram over the corresponding AD unit to permit rapid correlation between the observed major alarm and the failed equipment. The switches and indicators are described below.

- The MAJOR ALARM lamp indicates that one or more alarms which were designated as major (by electrical strapping) is in an alarm state.

- The ALARM lamp is lighted whenever any alarm on the scanner is activated.

- The Acknowledgement feature is intended to call the attention of local personnel to the existence of a new alarm state, and to allow personnel at the master alarm display to determine whether personnel at the scanner location are cognizant of new alarm states.

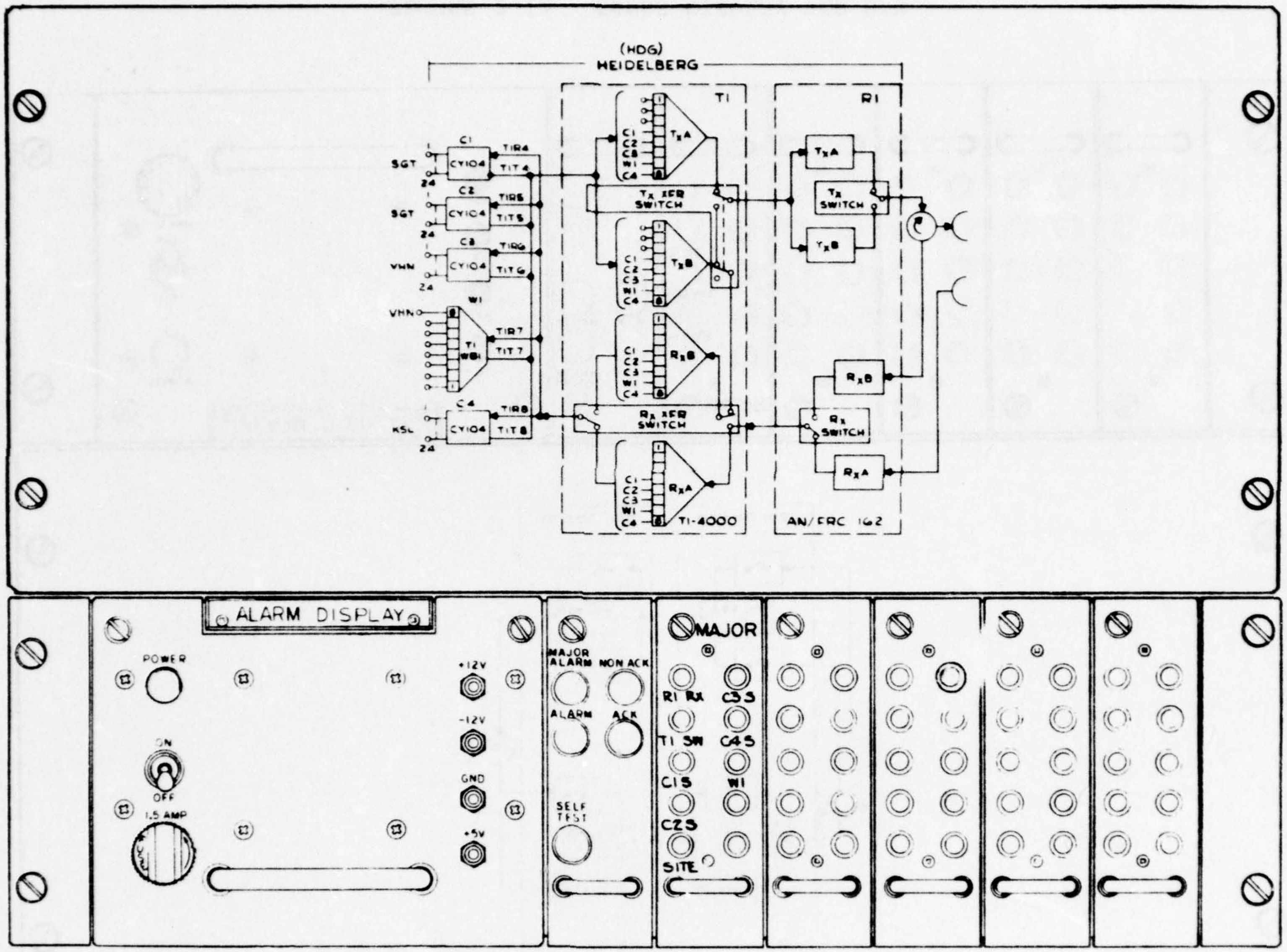


FIGURE 2-11. SSFSS DISPLAY FOR HDG

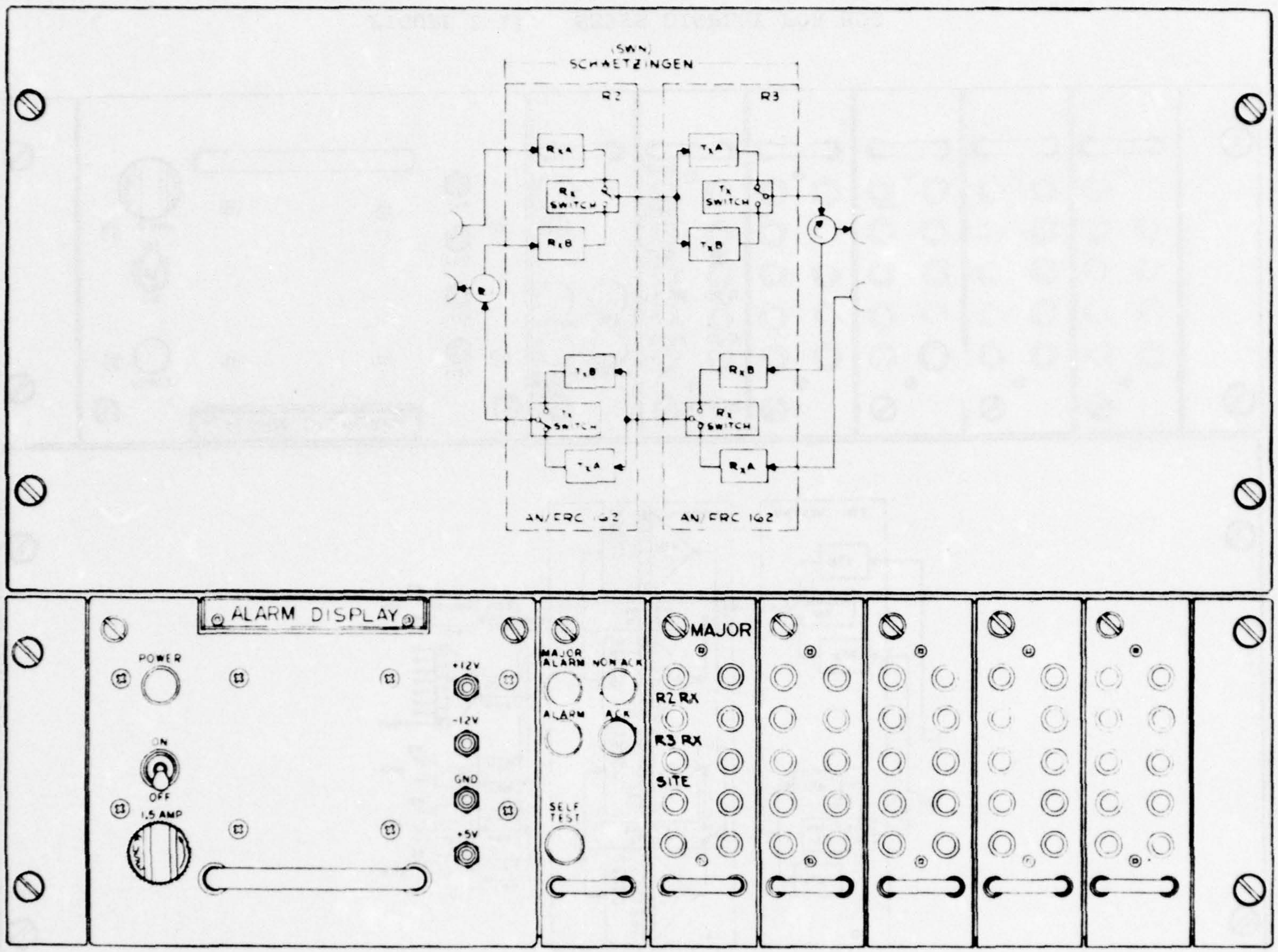


FIGURE 2-12. SSFSS DISPLAY FOR SWN

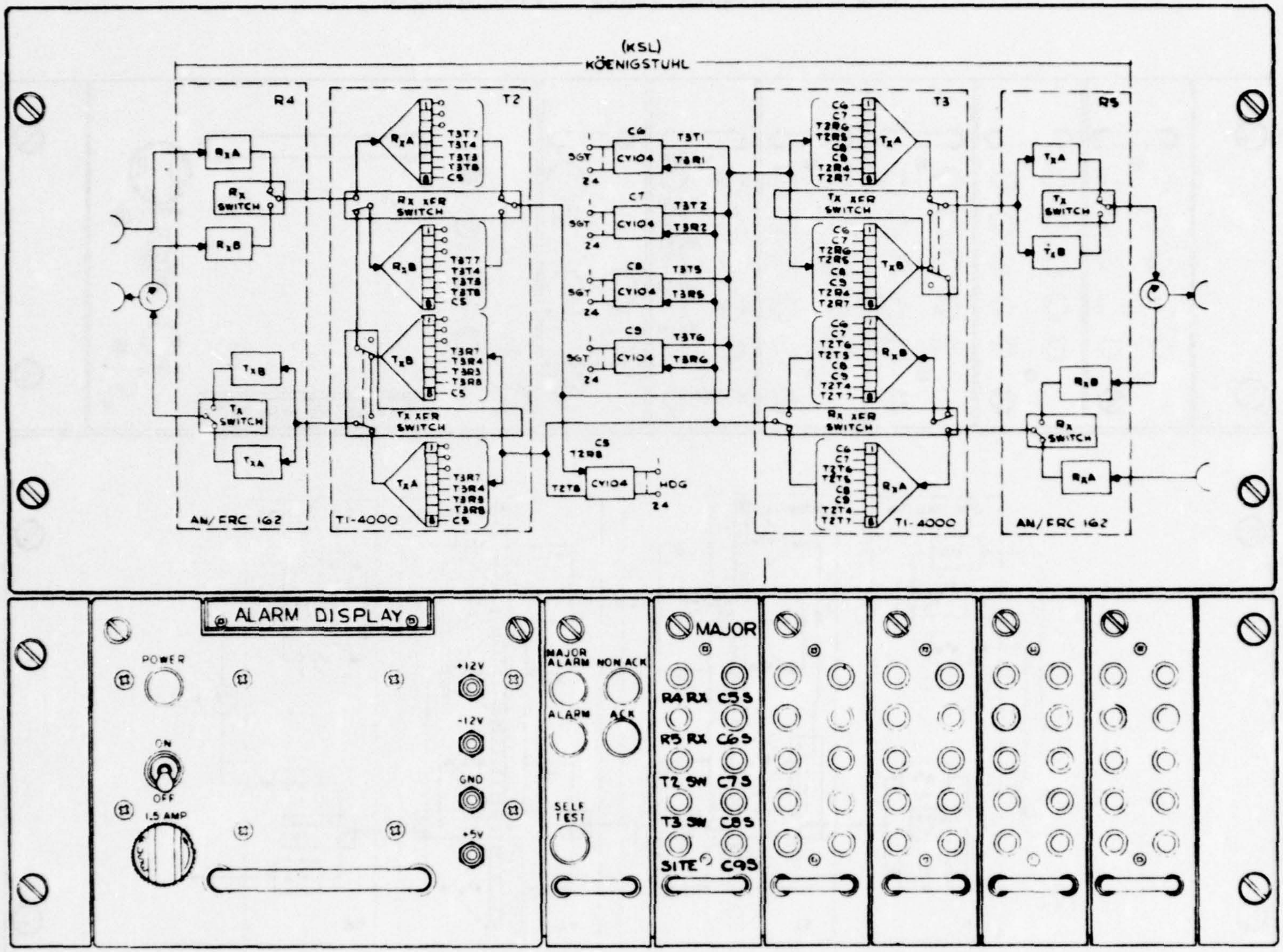


FIGURE 2-13. SSFSS DISPLAY FOR KSL

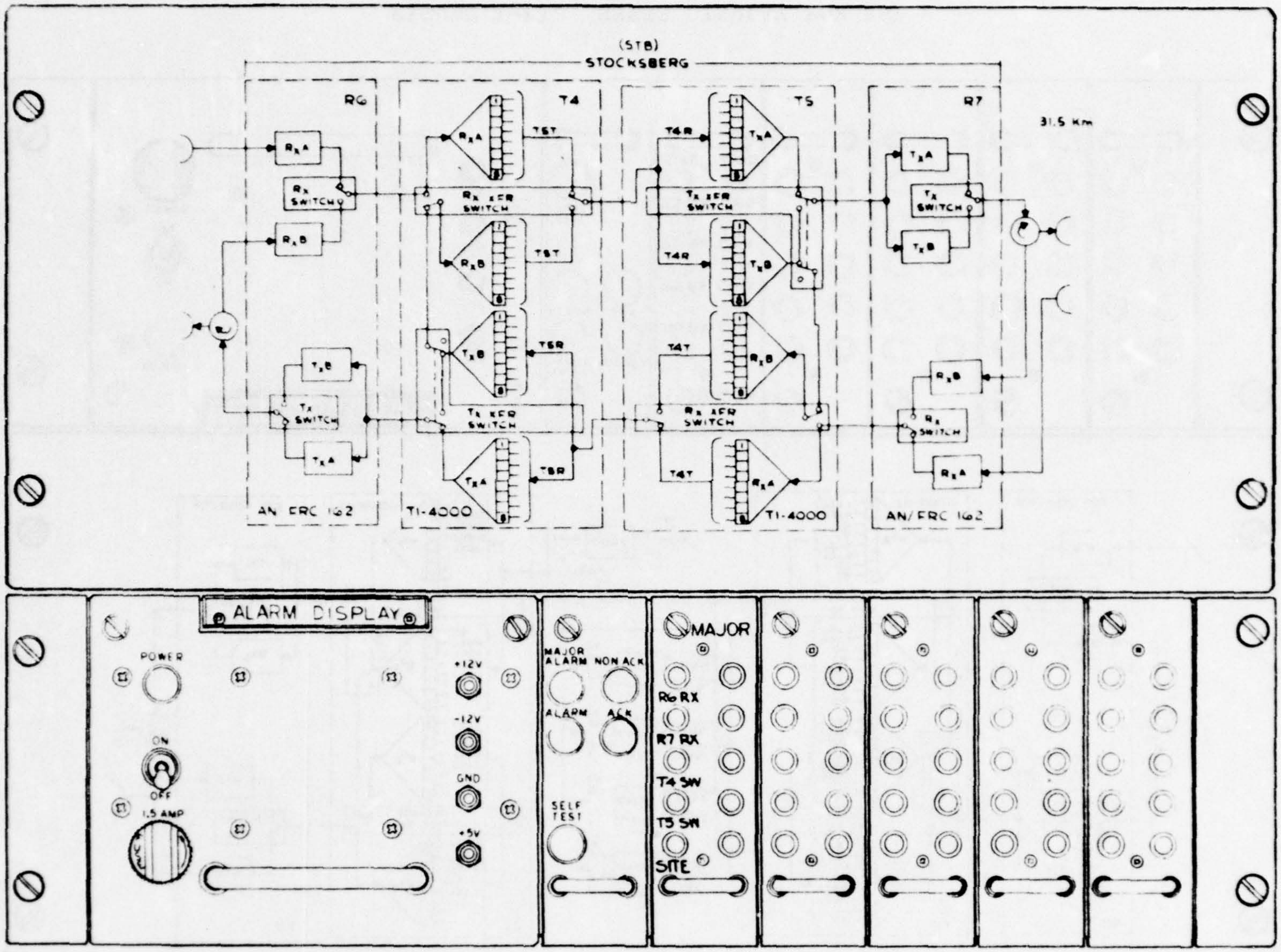


FIGURE 2-14. SSFSS DISPLAY FOR STB

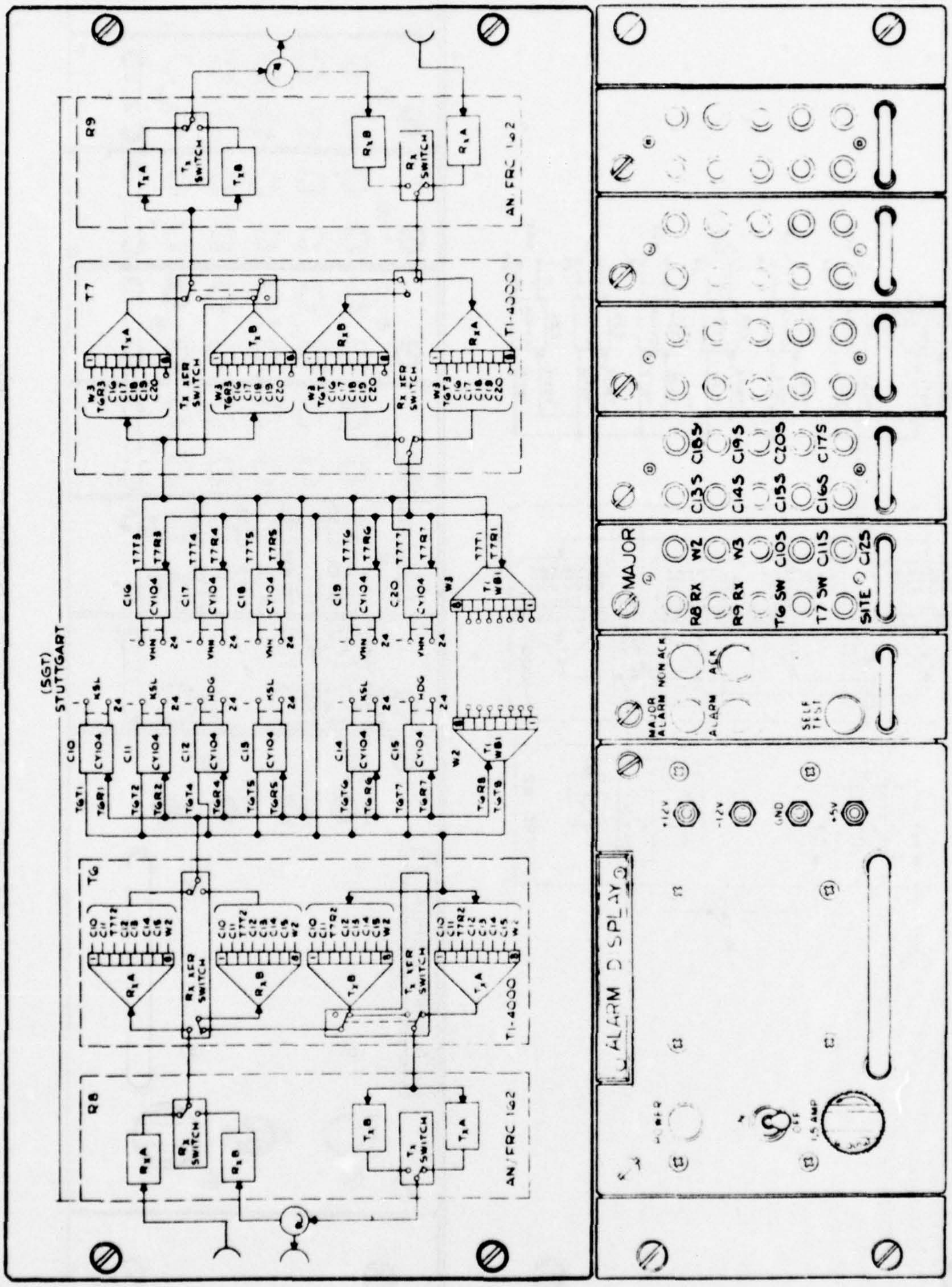


FIGURE 2-15. SSFSS DISPLAY FOR SGT

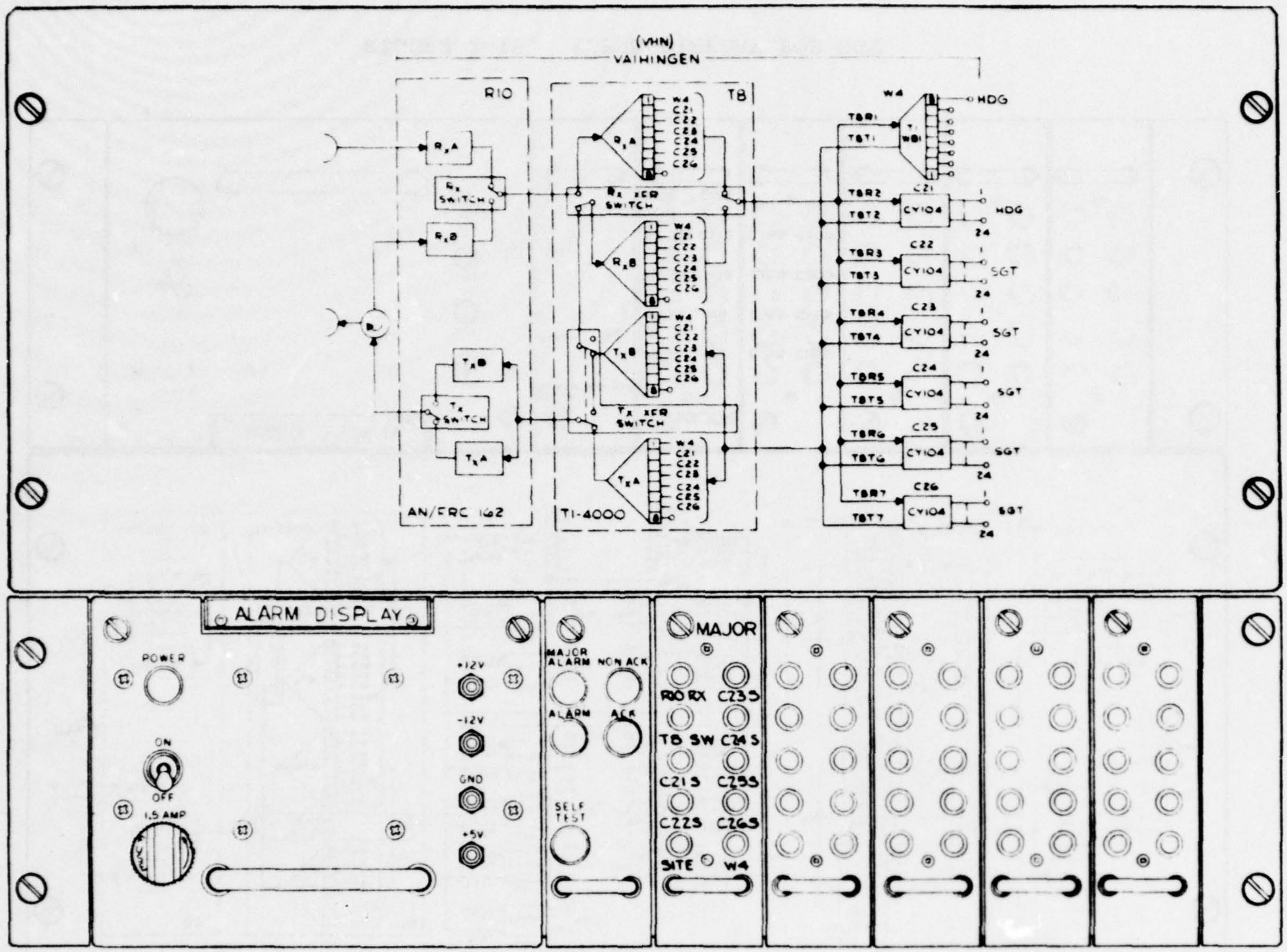


FIGURE 2-16. SSFSS DISPLAY FOR VHN

- Whenever a new alarm occurs, the NON-ACK lamp lights, and the LED indicator lamp for that particular alarm blinks. Simultaneously, a bit is placed in the outgoing data to indicate that a new alarm exists unacknowledged by local personnel.

- To acknowledge the alarm, the ACK pushbutton is depressed. This turns off the NON-ACK lamp; causes the new alarm LED indicator lamps to revert to a steady "on" state, and causes the "non-acknowledged" bit in the outgoing data stream to revert to normal.

- The acknowledgment function may also be wired in so that it can be performed from an alarm display unit remote from the scanner itself.

- SELF TEST tests the LED's and some of the internal logic. A successful test will cause all of the LED indicators to reverse their state.

2.7 SYSTEM OUTPUTS

2.7.1 Physical Aspects

The means by which system control personnel receive information are by alarm displays; CRT Displays, and a medium speed printer.

The alarm displays are standard ATEC display, one per site, with associated FKV system drawings, as shown in Figures 2-11 through 2-16.

The CRT is a standard character oriented unit with 80 characters per line and 24 lines, and a keyboard for entry of operator instructions to the PATE.

The printer is driven directly from the display, so that any display may be captured in print.

2.7.2 Display Types and Functions

The types of displays used, together with illustrations of their currently conceived organization and contents are detailed in Volume II, Subsection 3.4. This paragraph will summarize their salient features. The interrelationship of the display structures is shown in Figure 2-17.

The Master Alarm Display, through its alarm sensing capability, provides a visual indication of the existance of alarm conditions on the alarm scanners.

The Alarm Display stack has the primary function of indicating the geographical location of service failures, in the network. Other alarms and status indicators are also displayed, with their obtrusiveness lessened, so that the SSFSS indications standout (see Figures 2-2 through 2-7).

The highest level CRT display is the systems overview display. It provides a current summary of system aberrations, by indicating equipment alarms not limited to service failure, and indications of parameters which are outside their tolerance. It is organized by link and site so that the relationship of failure or degradation to the communication system may be readily perceived.

The next level of output is the link status display. This is an indication of the current status of the link, including alarm states, equipment in service, monitored parameter values, and site alarms at each end of the link. This display is used for detailed examination of failures and evident degradation.

Below this, in terms of immediacy, is the performance assessment displays, one for each link with three pages per display. These provide the last measured values of monitored and derived parameters, together with statistical running averages of past values extending over hourly, daily, monthly, and 30 month periods. The primary functions of this display are to detect and localize degradation which has developed over a considerable time period.

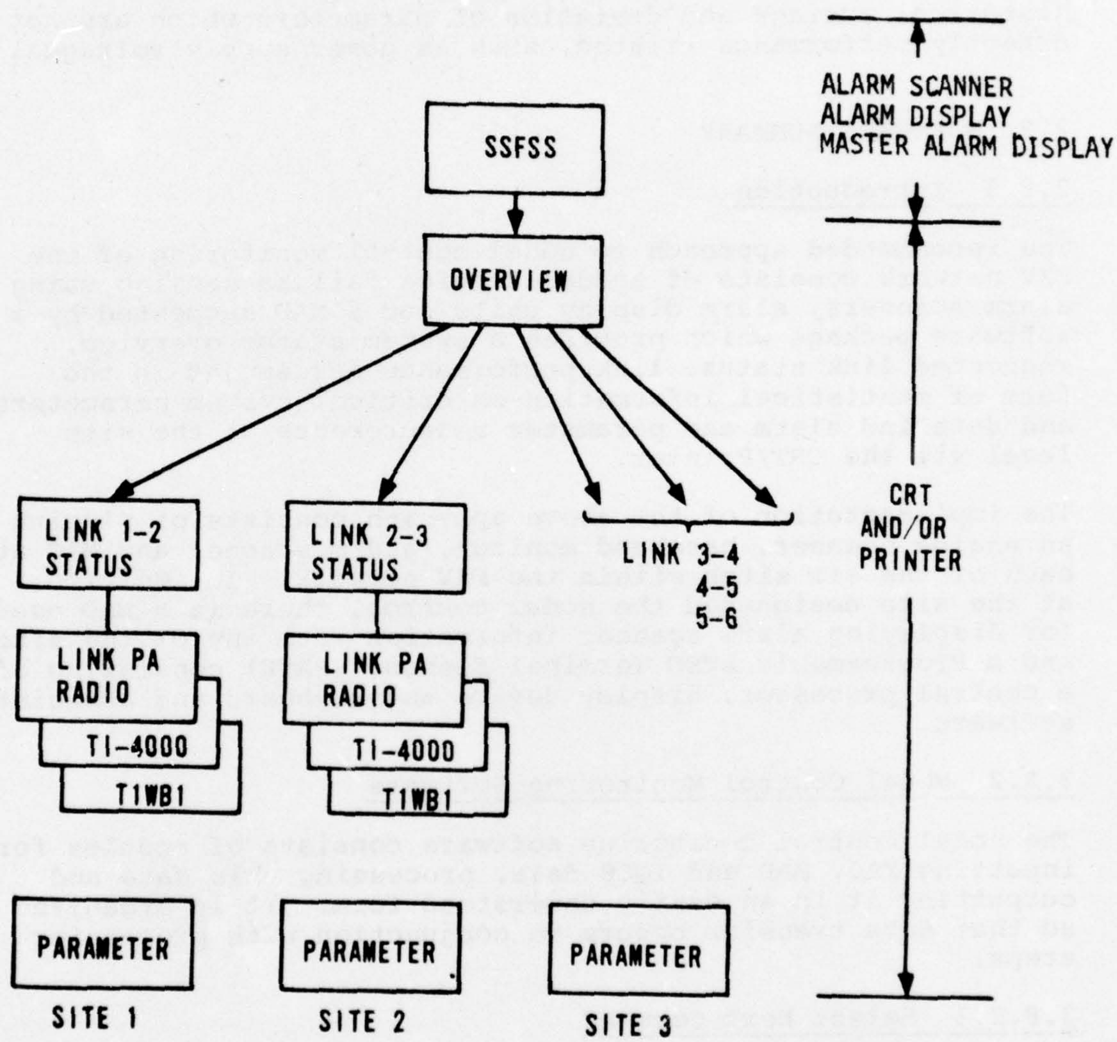


FIGURE 2-17. RELATIONSHIPS AMONG DISPLAYS

The last type of display is the site parameter display. This has the function of displaying the present value, and historical average and deviation of parameters which are not directly performance related, such as power supply voltages.

2.8 SOFTWARE SUMMARY

2.8.1 Introduction

The recommended approach to nodal control monitoring of the FKV network consists of sudden service failure sensing using alarm scanners, alarm display units and a MAD augmented by a software package which provides a system status overview, requested link status, link performance assessment in the form of statistical information on critical system parameters and detailed alarm and parameter measurements at the site level via the CRT/Printer.

The implementation of the above approach consists of placing an analog scanner, baseband monitor, alarm scanner and MAC at each of the six sites within the FKV network. In addition, at the site designated the nodal control, there is a MAD used for displaying alarm scanner information from any of the sites and a Programmable ATEC Terminal Element (PATE) consisting of a central processor, display device and keyboard and associated software.

2.8.2 Nodal Control Monitoring Software

The nodal control monitoring software consists of modules for inputting MAC, MAD and IQCS data, processing this data and outputting it in an easily understood form. It is organized so that data transfer occurs in conjunction with processing steps.

2.8.2.1 Select Next Command

There are four selection modes: (a) retransmission, (b) major alarm scan, (c) special site table selection and (d) normal selection.

a. If the retransmission flag is set, then the response to the last command is in error and the command must be retransmitted.

b. The alarm summary queue is a single entry queue. If its contents are non-zero, then the normal scan process has detected a major alarm and the higher priority major alarm scan is in process. In this mode of selection, the next command will be that contained in the alarm summary queue.

c. The special site table is a command table generated whenever the operator requests a special display such as link status or site parameters (see 2.8.5 Nodal Control Operator Interaction). If the site table flag is set the next command is taken from the table.

d. The equipment alarms and parameters throughout the FKV network have been classified as major alarms, alarms, analog parameters, analog parameters for maintenance, status alarms, VF channel status, and digital parameters measured as analog parameters. It has been determined that the following cycle times are adequate for nodal control monitoring.

1.	Major Alarms	every 30 seconds
2.	VF channel status	every 30 seconds
3.	Alarms	every 3 minutes
4.	Status	every 5 minutes
5.	Analog and Digital parameters	every 15 minutes
6.	Maintenance parameters	every 6 hours

In the normal monitoring mode, alarms and parameters are input in the above cycle times and the status reported with the system overview display. In the mode of selection the next command is determined so as to meet the above cycle time criteria.

The output of the SELECT NEXT COMMAND step is a two word command. These two words contain all of the information required to format a command for the MAC or MAD, process the results and output a display if required. The from and to channel numbers are included in order to provide the capability of scanning multiple channels with a MAC.

2.8.2.2 Transfer Command to Line Output Buffer

The transmission of commands to the MAC or MAD is accomplished by transferring the command to the line output buffer and using controller input interrupts. During the transfer the command is decoded and the appropriate string of ASCII characters placed in the line output buffer. Then the controller input interrupt is enabled, which causes an entry into the processing routine whenever the controller is ready for another character. When entered, the processing routine outputs a character to the controller. When all characters have been outputted, the controller interrupt is disabled.

2.8.2.3 Check for Response Errors

Data is received from the MAC or MAD by the controller output interrupt module. An interrupt occurs when the controller has a character. This causes an entry into the processing module which stores the character in the line input buffer and checks for end of message. When this occurs, an end of message flag is set. If the checksum and echo back response is okay, the message is then transferred to the results buffer for further processing. If the checksum or echo back is in error, the retransmit flag is set. If retransmission has already occurred three times, then a message is given to the operator indicating that the MAC or MAD is inoperative.

2.8.2.4 Initiate IQCS Measurement

The INITIATE IQCS MEASUREMENT segment provides the control linkages required when a VF channel status command is selected. It schedules the IQCS measurement task than it schedules the START NODAL CONTROL SCAN module with a special entry for processing the results when it is executed.

2.8.3 Results Processing

After data is received and found to be error free, it is processed. Results can be obtained from (1) MAD poll command, (2) MAD alarm summary command, (3) MAC dc voltage measurements or (4) an IQCS measurement.

2.8.3.1 MAD Poll Response

The MAD is continuously receiving alarm scanner information describing the status of alarms on a particular scanner. Alarms on a scanner may be "wired" as major alarms. If the MAD determines that the status of major alarms on a scanner has gone from no major alarms to one or more major alarms, it

sets an alarm scanner major alarm indicator. There is an indicator for each alarm scanner connected to the MAD (a maximum of 10). The response to a MAD poll command will be a positive acknowledgment (the character +) if none of the major alarm indicators have changed since the last poll command. If any indicator has changed, then the response is the state (1 or 0) of all indicators.

The software responsible for processing MAD poll responses maintains the status of the major alarm indicators in core. If a positive acknowledgement is received and the major alarm status word is zero, no further processing is required. However, if it is non-zero, a major alarm scan is entered. In a major alarm scan the status of all alarms on all alarm scanners whose major alarm indicators are set is obtained.

If an indicator status update is received in response to a MAD poll command, this information is used to update the in core status word.

2.8.3.2 Alarm Summary Response

The response to an alarm summary command is the status of all alarms on the specified alarm scanner. Processing for this response involves transferring the data to the site data base. If a major alarm scan is in progress, the next alarm scanner is determined and placed in the alarm summary queue.

2.8.3.3 MAC Voltage Response

The response to a MAC voltage measurement is first converted to floating point and transferred to the site data base. Parameters are then calculated. The alarm status, if required, is determined and if trending is indicated, then mean and standard deviations are calculated.

2.8.3.4 IQCS Response

The response to an IQCS measurement is the alarm status (Red, Amber, Green) of the measured VF channel. The IQCS measurement task transfers this information to disc. When the nodal control monitor task is reloaded, the PATE executive transfers the stored information to an internal buffer. The PROCESS RESULTS module has access to this buffer and transfers the data to the site data base.

2.8.4 Output

Output involves reading the required display from disc, formatting it and transferring it to the CRT. This module will output one of eight displays depending upon the display type as shown in Table 2-5. The site table contains anywhere from one to six site identifiers depending on the display being generated. For each site in the table, the site data base and a site display map is read from the disc. The display map indicates the parameter to be obtained from the data base and the location where it is to be placed on the display. After all sites have been processed, the display is sent to the CRT.

2.8.5 Nodal Control Operator Interaction

Nodal control operator interaction is scheduled when a common PATE command is entered with the characters NC preceding it. This module inputs the command, decodes it and calls the appropriate module to process it.

Commands available are:

1. LP - Display Link Performance Assessment
2. LS - Display Link Status
3. SP - Display Site Parameters
4. AA - Access Alarm Thresholds
5. CA - Change Alarm Thresholds
6. AL - Add to Alarm Library
7. DL - Delete from Alarm Library
8. LL - List Alarm Library
9. TS - Tag for Statistics
10. RS - Reset Statistics
11. RN - Return to Nodal Scan
12. PS - Display Parameter Statistics

TABLE 2-5. OUTPUT DISPLAY TYPES

0 - System Overview

1 - Link Status - Level 1

2 - Link Status - Level 2

3 - Link PA - Level 1 (Rx-Radio)

4 - Link PA - Level 2 (Rx-T1-4000)

5 - Link PA - Level 3 (Rx-T1WB1)

6 - Site Parameters

Command structure will be:

NC, CC, ARG1, ARG2, ..., ARG10

where CC is the command mnemonic. The mnemonic is followed by anywhere from zero to ten arguments (ARG1, ARG2, etc.) as required by the particular command. Arguments are separated from the command mnemonic and each other with commas (,).

The end of a command line is specified when the operator types a carriage return. A given command line can be restarted any time before typing the carriage return by depressing the DELETE key.

2.8.5.1 NC, LP

This command is used to display link performance assessment (one of four displays). The command is placed in the site command table.

Arguments:

ARG1 - Site number 1 (1-6)

ARG2 - Site number 2 (1-6)

ARG3 - Display level (1-3)

1 - Rx - Radio

2 - Rx - T1-4000

3 - Rx - T1WB1

2.8.5.2 NC, LS

This command is used to display link status. The command is placed in the site command table.

Arguments:

ARG1 - Site number 1 (1-6)

ARG2 - Site number 2 (1-6)

ARG3 - Display level (1-2)

2.8.5.3 NC, SP

This command is used to display site parameters for a given site. The command is placed in the site command table.

Arguments:

ARG1 - Site number (1-6)

2.8.5.4 NC, AA

This command provides access to alarm thresholds. All thresholds are contained in the Alarm Threshold Library. Each parameter references a set of alarm thresholds via an index (item 2, Site Parameter Table 2-6).

Arguments:

ARG1 - Site number (1-6)

ARG2 - Parameter number (1-64)

TABLE 2-6. PARAMETER TABLE DESCRIPTION

Item	Description	Words	
1	Parameter Value	2	Per Parameter
2	Alarm Threshold Indicator	1/2	
3	Alarm Status	1/2	
4	Statistics Pointer	1	

2.8.5.5 NC, CA

This command is used to change alarm thresholds. Item 2 in the parameter table will be changed. (Table 2-6).

Arguments:

ARG1 - Site number (1-6)

ARG2 - Parameter number (1-64)

ARG3 - Threshold index (1-100)

Index must be previously defined in the Alarm Threshold Library.

2.8.5.6 NC, AL

This command is used to add to the Alarm Threshold Library.

Arguments:

ARG1 - Index (not previously used) (1-100)

ARG2 - Red high threshold

ARG3 - Amber high threshold

ARG4 - Center green value

ARG5 - Amber low threshold

ARG6 - Red low threshold

2.8.5.7 NC, DI

This command is used to delete a set of thresholds from the Alarm Threshold Library.

Arguments:

ARG1 - Index (previously defined) (1-100)

2.8.5.8 NC, LL

This command is used to list the Alarm Threshold Library.

Arguments:

None

2.8.5.9 NC, TS

This command is used to tag a parameter for statistics. This is accomplished by reserving a disc sector to store history data. The pointer to the disc sector is Item 4 of the Parameter Table. (Table 2-6).

Arguments:

ARG1 - Site number (1-6)

ARG2 - Parameter number (1-64)

2.8.5.10 NC, RS

This command is used to reset parameter statistics. For each item number given a new value is inserted.

Arguments:

ARG1 - Site number (1-6)

ARG2 - Parameter number (1-64)

Normal response to this command is indicated by the printout of a question mark (?). This means the program is ready to accept the parameter data. The operator enters the desired change by entering the item number, a comma, and the item value and terminates with a carriage return. After the change is made, the question mark again appears. The operator can continue making as many changes as desired. He gets out of this node by typing a carriage return when the question mark appears.

2.8.5.11 NC, RN

This command returns the user to Nodal Control Scan.

Arguments:

None

2.8.5.12 NC, PS

This command displays parameter statistics, all hourly, daily, monthly, 30-monthly means.

Arguments:

ARG1 - Site number (1-6)

ARG2 - Parameter number (1-64)

ARG3 - A or B for radio, T1-4000 only

2.8.6 Data Base Requirements

Table 2-7 defines the requirements of a site data base. Item 4, the pointer to alarm scanner data, points to an item in a disk file that contains alarm scanner information. The format of this item is shown in Table 2-8. The conversion indicator, Item 8 is used to get to the appropriate computation algorithm for parameter calculations. Parameter values are stored in a site parameter table. The item format of this table is shown in Table 2-6. If a parameter is tagged for statistics a disk sector is reserved to store history data.

The number of parameters is limited to 64/site (1 disk sector) for a maximum of 384.

The minimum core size is 16,384 words.
Disk capacity is 2.4 million words.
Current PATE system uses 614,000 words.
Estimated nodal control size is 122,880 words.

2.9 PA/FI/TA CHARACTERISTICS

2.9.1 Introduction

These paragraphs address the topic of how the Digital ATEC FKV system satisfies the requirements pertinent to Performance Assessment (PA), Trend Analysis (TA), and Fault Isolation (FI). In the following discussion, it is convenient and realistic to discuss both PA and TA as a single entity since the parameters which are useful for TA are also those which relate to PA by definition. Basic TA is simply the long term (as opposed to instantaneous) recording, smoothing and interpretation of PA parameters.

The requirement for adequate PA/TA capability of a monitoring scheme is that the scheme be able to quantitatively determine the degree to which the communications system and its elements is capable of achieving an intended performance criteria.

FI, as applied to the use of ATEC in the FKV system, is isolation of a known failure to an equipment. Since parametric measures in the sense of a meaningful range of parameter values does not apply to FI, FI may be considered separately from the tasks of PA and TA. Hence, for adequate FI capability, the FKV monitoring system must be capable of providing information which permits the system operator to fault isolate to the individual equipment level.

TABLE 2-7. SITE DATA BASE

Item	Description	Words	
1	MAD Address	1/2	Per Alarm Scanner
2	Number of Alarm Scanners	1/2	
3	Alarm Scanner Number	1/2	
4	Pointer to Alarm Scanner Data	1/2	
5	MAC Address	1	
6	Channel Number	1	Per Channel
7	Voltage	2	
8	Conversion Indicator	1/2	

Number Words = $1 + N_{AS} + 4\ N_{CH}$

Site Data Base / Site

Site	2 +	Number Alarm Scanners	+ 4 (Number Channels)		Total Words
STB	2 +	1	+ 4(50)	=	203
SWN	2 +	1	+ 4(30)	=	123
VHN	2 +	1	+ 4(40)	=	163
SGT	2 +	2	+ 4(80)	=	324
HDG	2 +	1	+ 4(60)	=	243

TABLE 2-8. ALARM SCANNER DATA

Item	Description	Words	
1	Time Updated	1	Per Alarm Scanner
2	Alarm Scanner Bits 0-15	1	
3	Alarm Scanner Bits 16-31	1	
4	Alarm Scanner Bits 32-47	1	
5	Alarm Scanner Bits 48-49	1	

1 MAD = 10 Alarm Scanners = 50 words

2.9.2 PA/TA Considerations

2.9.2.1 Availability

Availability is a useful PA/TA parameter because it provides a quantitative measure of the relative fraction of time during which the communications system is capable of performing its intended mission. For computation purposes, it is more convenient to calculate availability in terms of its opposite, unavailability.

The computed system parameter, unavailability, represents the percent of the total time that some specified parameter is below a specified threshold or value for the system or link under consideration. For the FKV, availability is applied to radio links and to BER as detailed below.

For a particular radio link, the radio link unavailability is defined as the fraction of scans for which the RSL was observed to be below a preset value as detected by the monitor system. The Analog Scanner/MAC is employed to periodically measure the RSL value for each radio path on a given link.

Error rate unavailability is computed from T1-4000 to T1-4000 and represents the percentage of time that the measured error rate exceeds a specified value. The Event per Unit Time Monitor/Analog Scanner/MAC is employed to periodically measure the T1-4000 main frame bit errors.

2.9.2.2 Bit Error Rate

Bit Error Rate (BER) is a useful PA/TA parameter since it provides a quantative measure of the relative performance of a digital communications system.

System BER is computed in three ways within the FKV performance monitoring system. The three ways are on a radio link basis, on a T1-4000 to T1-4000 basis, and on a user to user or equivalently, a T1WB1 to T1WB1 basis.

RF link BER from radio Tx baseband input to radio Rx output is estimated from measurements performed upon the three-level eye pattern scatter. The eye amplitude, noise or dispersion, and the burst-like character of the eye noise is measured by the baseband monitor. This information is then transferred to the PATE. From the measured eye pattern dispersion or noise,

the error rate due to the dispersion may be estimated by means of a look-up table. This table stores values of BER for the partial response waveform as a function of measured eye pattern dispersion.

The actual link BER from T1-4000 to T1-4000 is extrapolated from the measured T1-4000 main framing bit error rate. Actual digital user to digital user BER is also extrapolated from measurements of the low level T1WB1 multiplexer frame bit errors.

As dictated by the hardware design of the error counter (EPUT), T1-4000 error rates as high as 1×10^{-3} may be measured if a measurement interval of four minutes is employed. T1WB1 error rates as high as 1.7×10^{-2} may be measured by the EPUT if a four-minute measurement interval is employed.

2.9.2.3 Performance Margin

Performance margin is a useful system parameter since it provides a measure of the margin between the current system operation and the level of operation at which the system would be classed as unavailable. The margin may be quantatively measured in BER above a set threshold or in terms of RSL above a specific threshold.

With regard to those portions of the communications system which may be classified as analog in nature, two measures of performance are radio received signal level (RSL) and baseband, 3-level partial response eye noise.

RSL as measured by means of the Analog Scanner/MAC may be directly translated into a dB above fade number or equivalently a fade margin value in dB. The measured value to margin value translation process is accomplished by means of a PATE look-up table. The trends observed in RSL are also useful for performance margin determination. For example, a poor RSL value trending constant indicates a constant performance margin while a poor RSL trending poorer indicates decreasing performance margin.

As shown in Table 2-3, for the scan rate chosen for the monitoring system, RSL as an analog parameter is measured every 15 minutes in each radio receiver.

As detailed above in paragraph 2.9.2.2, the measured value of eye pattern dispersion or noise may be translated into an

equivalent BER. The difference between this BER and a BER value of 10^{-7} provides a BER performance margin. 10^{-7} should be regarded as an arbitrary and changeable reference point at which an unacceptably high BER is present.

While RSL provides information as to the radio path and radio transmitting system, the eye scatter/BER performance margin pertains to the combined radio transmitter and receiver, multiplexer receiver, and RF path since the eye scatter is measured at a point between the radio receiver output and the T1-4000 input.

2.9.2.4 Noise (Equivalent PCM)

Noise (PCM) is a useful system level parameter as it provides a direct measure of the communication system performance as seen by the PCM or VF channel user.

At SGT, where a PATE configured IQCS is available, in-service VF measurements are performed upon selected CY-104 channels. If the channel is determined to be idle, through recognition of the supervisory tone, by means of software analysis, the resultant IQCS signal measurement provides a measure of the VF channel quantizing noise. This idle channel noise floor, in normal system operation, is equivalent to the PCM noise floor as would be measured by means of a notched tone measurement made with a low level tone. Hence, the idle channel PCM noise provides an equivalent PCM noise and may be employed to assess the user to user PCM system performance.

The actual in-service VF measurement and an analysis is accomplished by an IQCS. The IQCS samples the VF signal and performs a FFT to obtain the power density spectrum of the signal on VF channel. If a 2600 Hz tone is present, it is detected by a software spectral analysis routine and the tone notched from the spectrum by means of software processing. Further processing yields the ratio of total power (noise plus tone) to noise power (no tone and residual noise). If no tone is determined to be present, the noise is computed and interpreted as idle channel PCM noise.

2.9.3 FI Consideration

To isolate a fault to an equipment within the FKV, a hierarchical approach to the use and interpretation of monitor points is employed. The proposed FI approach is to examine the following:

1. Status of the Major Alarm monitor points by means of the SSFSS.

2. Status of the Alarm Monitor points by means of the AS and AD units.

3. Status of the Status Monitoring points by means of the AS and AD units.

4. Status of the Analog/Digital alarms/parameters by means of the CRT.

This sequential process is diagrammed in Figure 2-18.

The strategy employed in examining monitor points to reveal the failed equipment is to employ a top down strategy, that is to determine the highest level alarm or parameter condition which could be responsible for the observed cascade of failure indications. In the FKV system the highest level failures are related to the RF path and radios. The second highest level is the T1-4000 multiplexers. The third highest level is the low level T1WB1 multiplexers and the lowest level is comprised of the CY-104 or user interface equipment. This top down approach to failure isolation is illustrated in Figure 2-19.

By way of a representative example, consider an assumed loss of the KSL to STB RF link which would cause the alarm cascade condition illustrated in Figure 2-20. In this figure, the activated alarms are denoted by a plus. The lowest level alarms observed are the CY-104 service alarms and the T1WB1 office alarms. The next higher level is composed of T1-4000 switch major alarms. However, the highest level observed is the R7 radio Rx indicating loss of signal on both radio receivers. Thus a RF path or radio transmitter problem may be postulated. Since common path problems are highly unlikely and assuming no transmitter alarms are observed on alarm scan of the transmit site, the conclusion to be reached is that the problem lies in the transmitting antenna system at SGT. The link status display for the assumed failure is given in Figure 2-21.

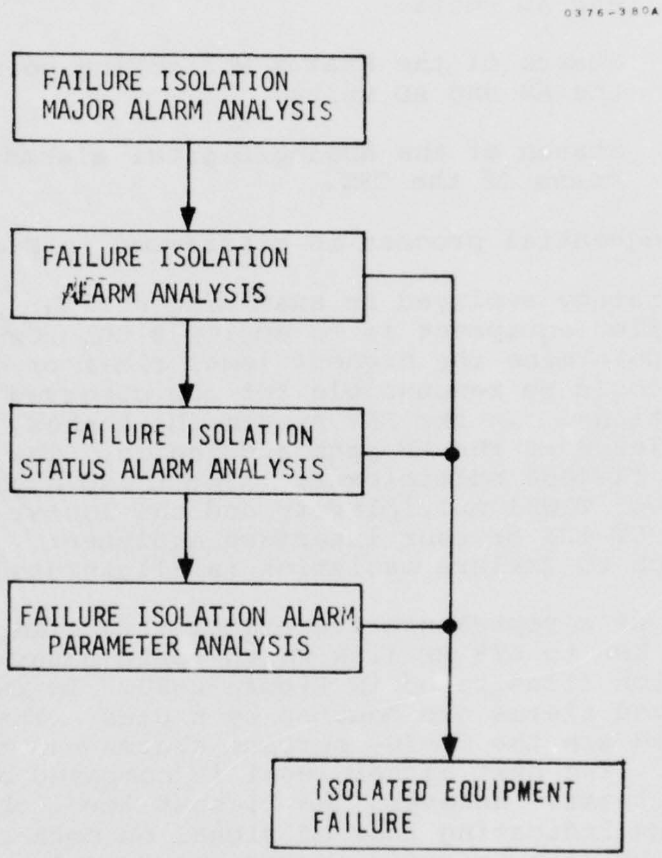
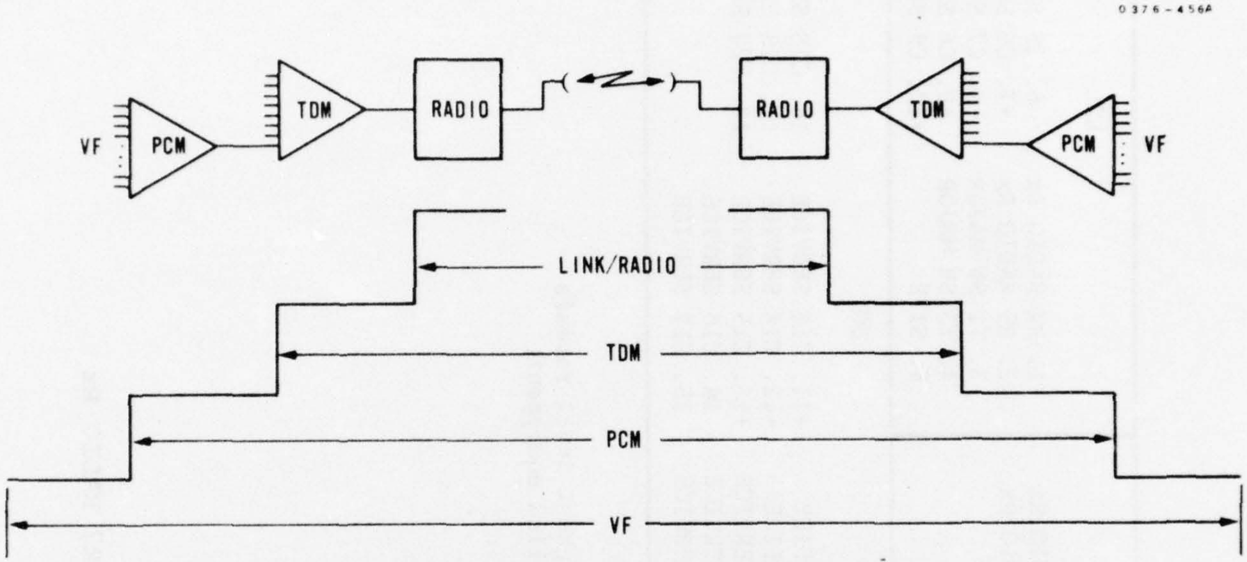


FIGURE 2-18. FAULT ISOLATION



- RADIO: RSL AND BASEBAND EYE MEASURES LINK AND RADIO PERFORMANCE
- TDM: PCM OPERATION MEASURES TDM EQUIPMENT PERFORMANCE
- PCM: VF OPERATION MEASURES PCM EQUIPMENT PERFORMANCE
- VF: VF PERFORMANCE CONFIRMS DIGITAL SYSTEM PERFORMANCE

FIGURE 2-19. DEGRADATION/FAULT ISOLATION STRATA

HDG

1. R1 RADIO Rx
2. T1 SW MAJOR
+3. C1 SERVICE
+4. C2 SERVICE
5. SITE
6. C3 SERVICE
7. C4 SERVICE
8. W1 OFFICE

SWN

1. R2 RADIO Rx
2. R3 RADIO Rx
3. SITE

KSL

1. R4 RADIO Rx
2. R5 RADIO Rx
3. T2 SW MAJOR
4. T3 SW MAJOR
5. SITE
6. C5 SERVICE
+7. C6 SERVICE
+8. C7 SERVICE
+9. C8 SERVICE
+10. C9 SERVICE

STB

1. R6 RADIO Rx
+2. R7 RADIO Rx ●
3. T4 SW MAJOR
+4. T5 SW MAJOR
5. SITE

SGT

1. R8 RADIO Rx
2. R9 RADIO Rx
+3. T6 SW MAJOR
4. T7 SW MAJOR
5. SITE
+6. W2 OFFICE
7. W3 OFFICE
+8. C10 SERVICE
+9. C11 SERVICE
+10. C12 SERVICE
+11. C13 SERVICE
+12. C14 SERVICE
+13. C15 SERVICE
14. C16 SERVICE
15. C17 SERVICE
16. C18 SERVICE
17. C19 SERVICE
18. C20 SERVICE

VHN

1. R10 RADIO Rx
2. T8 SW MAJOR
3. C21 SERVICE
4. C22 SERVICE
5. SITE
6. C23 SERVICE
7. C24 SERVICE
8. C25 SERVICE
9. C26 SERVICE
10. W4 OFFICE

● Highest level reveals failed equipment.

FIGURE 2-20. R7 RADIO Rx

LINK STATUS NO. 0219 STOCKSBERG - STUTTGART

	STB		SGT	
	T1-4000	RADIO	RADIO	T1-4000
ALARMS	* SW MAJOR	TX	TX	* SW MAJOR
	* SW MINOR	AB RX	RX	* SW MINOR
	AB MAJOR			A MAJOR
STATUS	A TX IN SVC	A TX IN SVC	A TX IN SVC	A TX IN SVC
	A RX IN SVC	A RX IN SVC	A RX IN SVC	A RX IN SVC
	MAINTENANCE	MAINTENANCE	MAINTENANCE	MAINTENANCE
PARAMETERS	INVLD FER	O RSL MARGIN	32 RSL MARGIN	E-7 FER
	AB REFRAME	0 EYE MARGIN	32 EYE MARGIN	B REFRAME
		+6 EYE AMPL	+3 EYE AMPL	
		EYE BURST	EYE BURST	
		* RX SQUELCH	RX SQUELCH	
		INVLD DERIVED BER	E-8 DERIVED BER	
	INVLD BER CORRELATION DIFF		E-0.8 BER CORRELATION DIFF	

FIGURE 2-21. LINK STATUS OUTPUT (R7A, R7B, NO RX PILOT) (PAGE 1)

Section 3

ATEC FKV DEMONSTRATION

3.1 INTRODUCTION

This section addresses the rationale employed in defining the proposed FKV demonstration and outlines the desired demonstration system technical objectives. The demonstration system is defined with respect to architecture, alarms collected, scan requirements and speed, telemetry configuration, displays, and software adaptations.

Paragraphs 3.2 through 3.6 are an extension of the corresponding Section 2, Paragraphs 2.2 through 2.6, which present detailed discussions of the relevant topics.

3.2 DEMONSTRATION SYSTEM CONFIGURATION RATIONALE

The proposed Digital ATEC FKV demonstration system is composed of the links between SGT and VHN. It encompasses all communications equipment at VHN and that communications equipment at SGT devoted to communicating with equipments at VHN. Essentially one-half of the SGT equipment and all of the VHN communications equipment is to be monitored.

The rationale for selecting the SGT to VHN portion of the FKV for a demonstration is based on the following considerations:

1. Access to both ends of a communications link or channel for the purposes of fault isolation and performance assessment is required. For, if both ends of a link are not under supervision by the monitoring system, FI and PA are difficult, if not impossible, as a consequence of the uncertainty associated with the operation and condition of the unsupervised link end.

2. For a valid demonstration of system capability and in order to be able to collect useful information as to the monitor system performance and limitations, a representative complement of the FKV communications equipment should be employed in the demonstration.

3. In order to minimize costs due to required monitor equipments and installation, only two sites need be monitored. To eliminate uncertainties associated with equipment not monitored by the system, these two sites should be adjacent.

4. Since a PATE will be available at HDG and SGT and the link between SGT and VHN is the only link satisfying Requirements 2 and 3, this link is proposed for the Digital ATEC demonstration.

3.3 DEMONSTRATION SYSTEM OBJECTIVES

The objectives (in descending order) of the Digital ATEC Demonstration are to verify:

1. The applicability and usefulness of the ATEC system and concepts in a digital communication system environment.

2. The usefulness of the parameters specified to be collected by these devices.

3. The ability of the SSFSS to rapidly alert the controller to gross system failures.

4. The usefulness of the interaction between the operator and the PATE system by means of the CRT display.

5. The substantiation of assumptions previously made with regard to communication system failure modes. In particular, the adequacy of the system parameters and alarm scan rate and scan sequence.

6. The adequacy of the maintenance parameter scan rate from the point of view of the maintenance scan being useful for system maintenance information.

7. Information pertaining to software operation in the areas of system control, operator interaction and algorithms employed in parameter estimation and smoothing.

3.4 FKV DEMONSTRATION SYSTEM DIAGRAM

A diagram of that portion of the FKV to be monitored is given in Figure 3-1. Note that all equipment at VHN and approximately one-half of the communications equipment at SGT is included in the demonstration system.

3.5 FKV DEMONSTRATION SYSTEM MONITOR POINTS

All demonstration system monitor points are detailed in Figures 3-2 and 3-3. The parameters are identical to those

FIGURES 3-1 THROUGH 3-3 LOCATED AT END OF VOLUME III

recommended as monitor points for the entire FKV system, only the number of specific monitor points has been reduced to reflect the demonstration configuration.

3.6 FKV DEMONSTRATION SYSTEM MONITORING EQUIPMENT AND TELEMETRY CONFIGURATION

The monitoring equipment and telemetry configuration for the SGT/VHN demonstration system is diagrammed in Figure 3-4. Equipment layout and interconnection for each site is illustrated in Figures 3-5 and 3-6.

Figure 3-7 illustrates the telemetry from SGT to VHN. This 150 bps channel is identical to that proposed for the SGT to remote site telemetry for overall monitoring of the entire FKV system. VHN to SGT telemetry is illustrated in Figure 3-8. The frequency and rate of the two channels is identical to that proposed for the VHN to SGT telemetry in the monitoring system for the entire FKV.

3.7 FKV DEMONSTRATION SYSTEM SCAN SUMMARY

The absolute time required to scan the parameters in the demonstration system are delineated in Table 3-1. All of the parameters of the overall system are scanned at VHN while one-half of the parameters of the overall system are scanned at SGT.

Table 3-2 presents the scan analysis summary for the demonstration system.

Given the proposed scan rates for the demonstration system, the resultant monitoring system reaction times are summarized in Table 3-3.

3.8 FKV DEMONSTRATION SYSTEM SUDDEN SERVICE FAILURE SENSING SYSTEM CONFIGURATION

SSFSS displays for the demonstration system are given in Figures 3-9 and 3-10. The display at SGT is a reduced version - by one half - of the display proposed for the overall system while the display at VHN is unchanged.

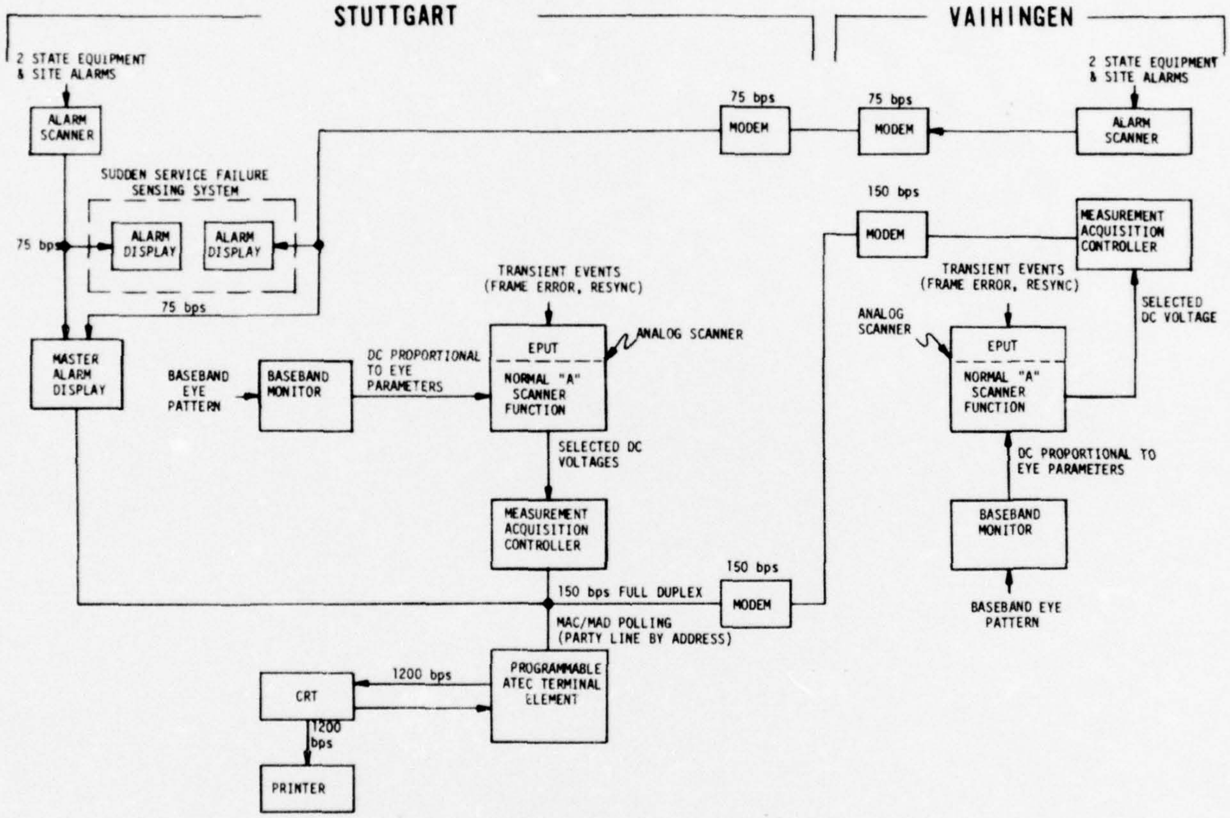


FIGURE 3-4. DEMONSTRATION EQUIPMENT/TELEMETRY CONFIGURATION

FIGURES 3-5 AND 3-6 LOCATED AT END OF VOLUME III

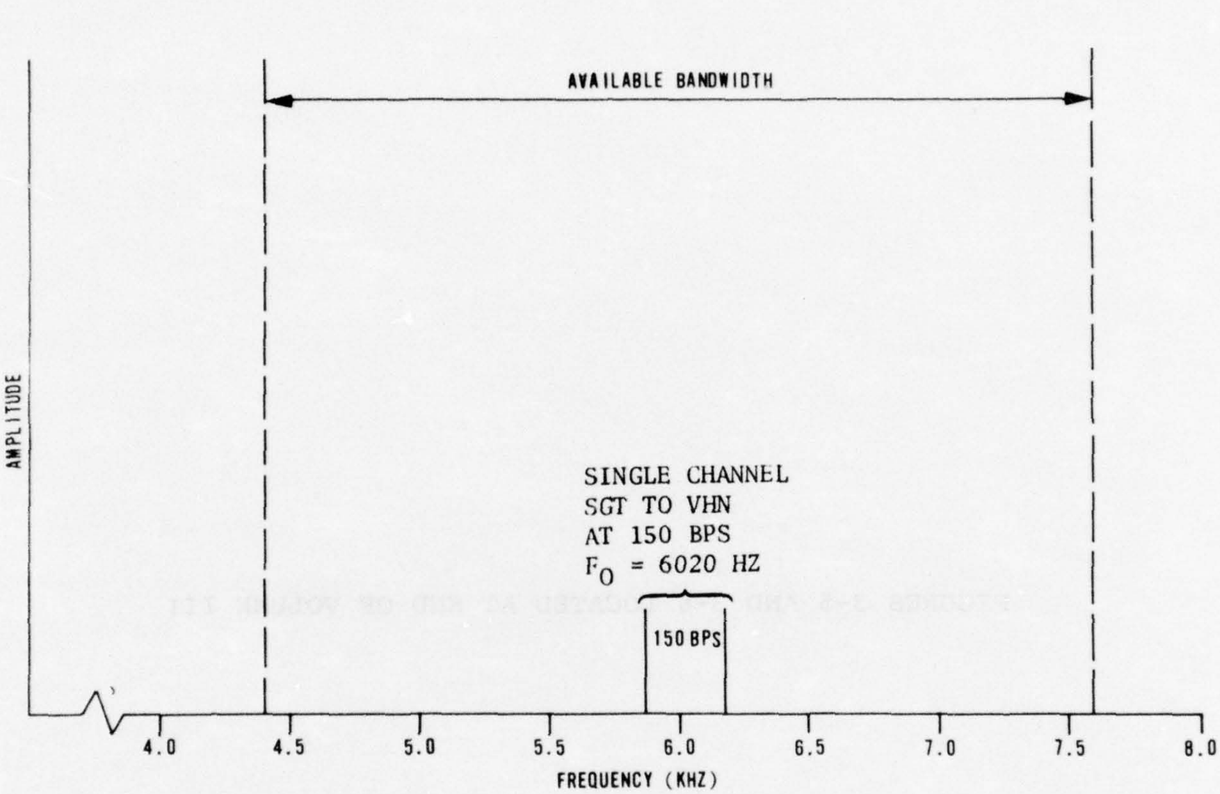


FIGURE 3-7. TELEMETRY - SGT TO VHN - DEMONSTRATION

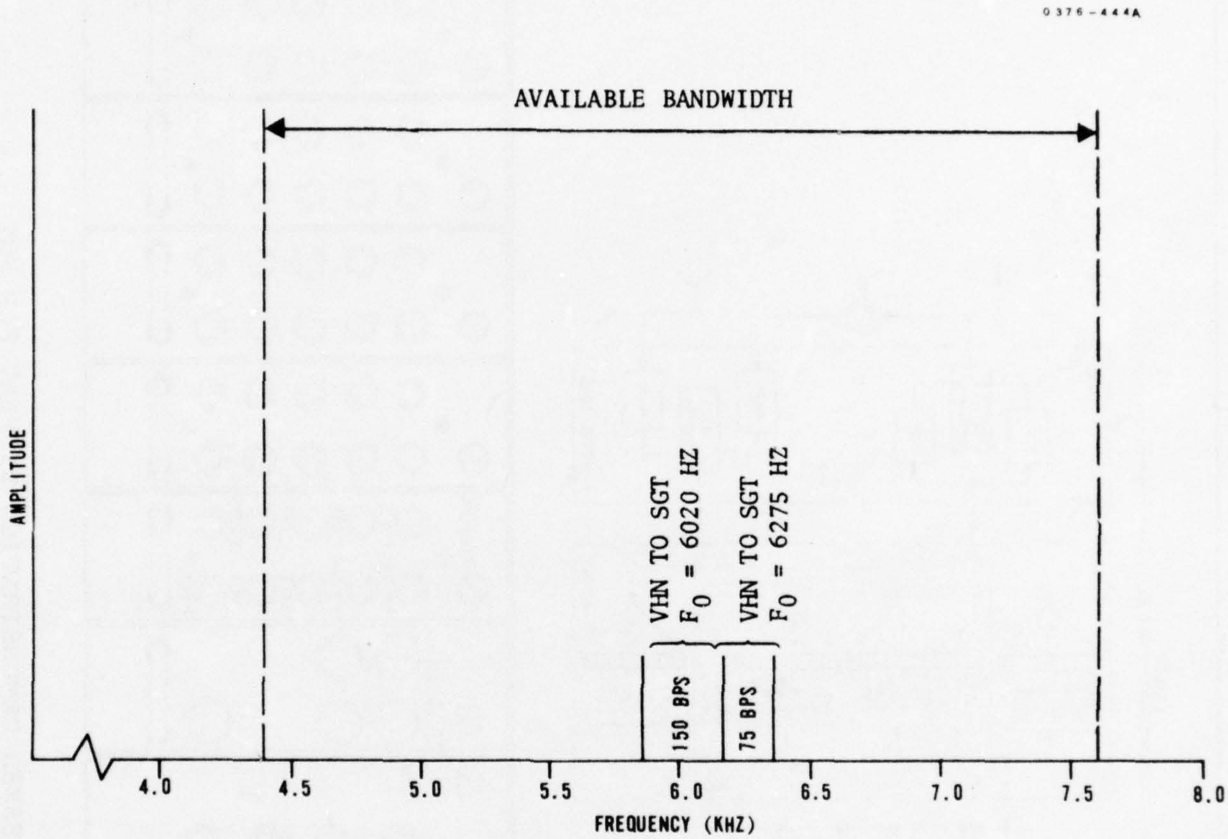


FIGURE 3-8. TELEMETRY - VHN TO SGT - DEMONSTRATION

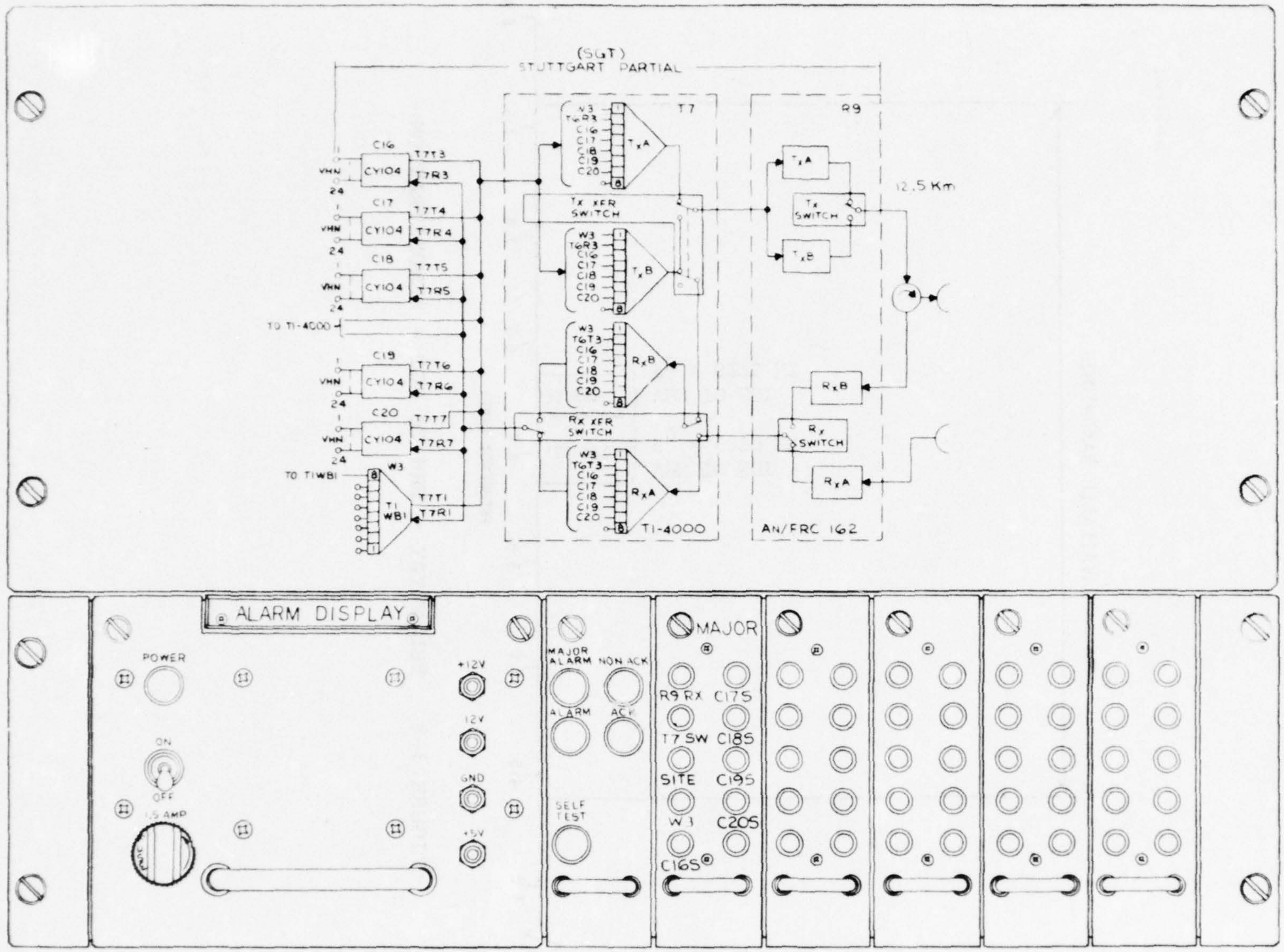


FIGURE 3-9. SSFSS DEMONSTRATION DISPLAY FOR SGT

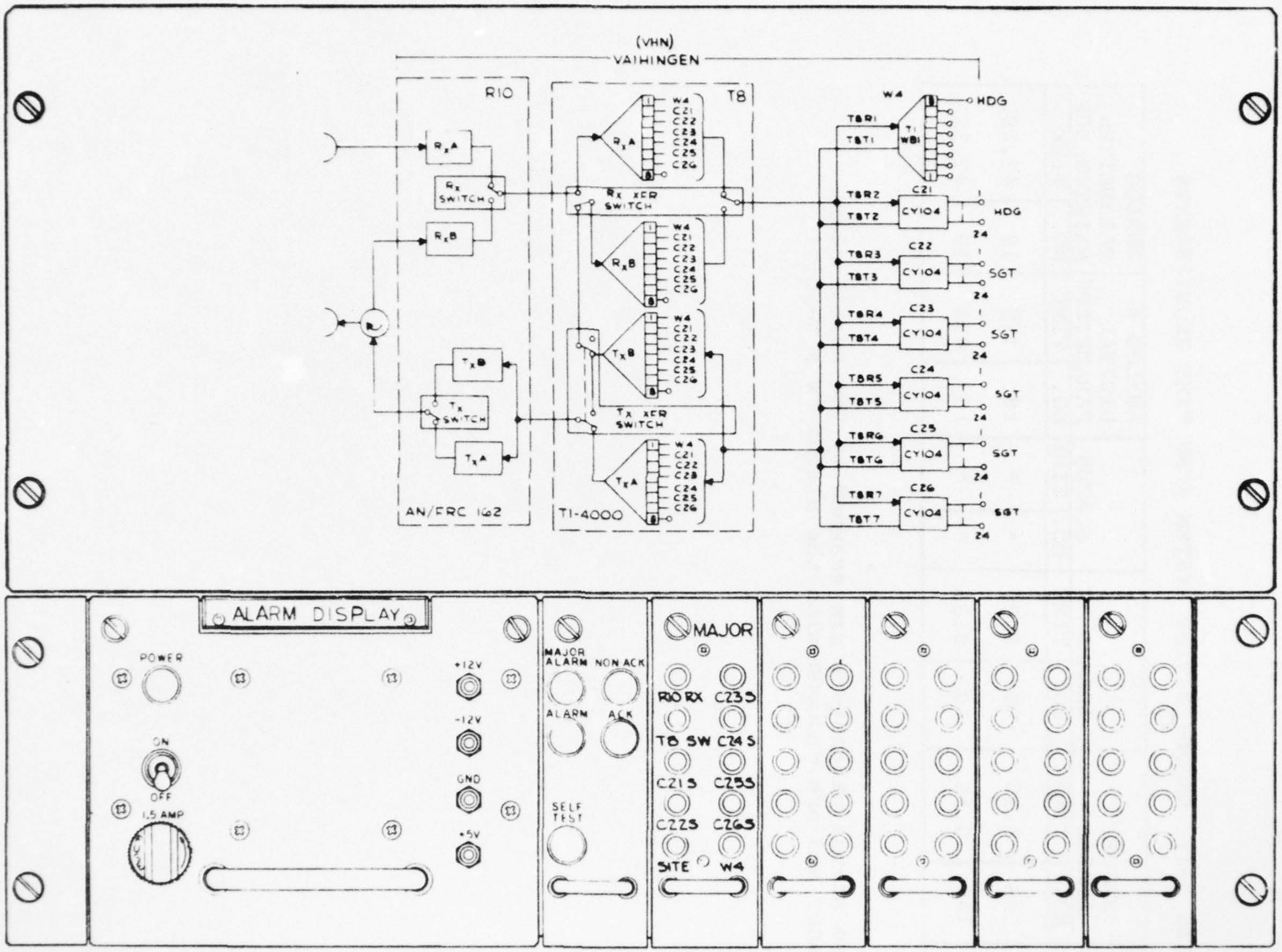


FIGURE 3-10. SSFSS DEMONSTRATION DISPLAY FOR VHN

TABLE 3-1. DEMONSTRATION SYSTEM SCAN TIME REQUIREMENTS

SITE	MAJOR ALARMS		ALARMS		STATUS		ANALOG & DIGITAL PARAMETERS		ANALOG PARAMETERS MAINTENANC	
	NO.	TIME	NO.	TIME	NO.	TIME	NO.	TIME	NO.	TIME
SGT	1AS	0.3S	39	8.2S	*	*	18	45S	19	47.5S
VHN	1AS	0.3S	40	8.2S	*	*	18	45S	19	47.5S

*These status parameters are scanned by the normal alarm scanner and are grouped with the alarms as a result.

TABLE 3-2. SGT-VHN DEMONSTRATION SYSTEM SCAN ANALYSIS

PARAMETER TYPE	SCAN CYCLE TIME: NO. OF TIMES PER DAY/(CYCLE)	SITE	ABSOLUTE TIME PER CYCLE	ABSOLUTE TIME PER CYCLE NORMALIZED TO 30-SECOND BASE
Alarms and Status*	1440/(1 Min)	SGT	8.2S	
		VHN	8.2S	
			16.4S total	8.19 Sec
A&DP	480/(3 Min)	SGT	45.0S	
		VHN	45.0S	
			90.0S total	15.00 Sec
AP/M	24/(1 Hr)	SGT	47.5S	
		VHN	47.5S	
			95.0S total	0.79 Sec
Major Alarms	2880/(30 Sec)	SGT	0.30S	
		VHN	0.30S	
			0.60S total	0.60 Sec
IQCS	2880/(30 Sec)		4.0S total	4.00 Sec
MAC Test	24/(1 Hr)		5.0S total	0.04 Sec
	Total Time Required Out of 30 Seconds			28.62 Total

*Status parameters are monitored by the single AS located at each site.

TABLE 3-3. REACTION TIME

Loss of Service	15 Sec Average	30 Sec Max
Loss of Standby	1-1/2 Min Average	3 Min Max
Equipment Degradation	7-1/2 Min Average	15 Min Max
Telemetry Degradation	10 Sec	---
ATEC Equipment Degradation	1/2 Hr Average	1 Hr Max

NOTE: All alarms are scanned once in 30 seconds. The scanning time of a particular alarm may be represented by a uniform probable density from 0 to 30 seconds. Hence, the mean time from a given time until a particular alarm is scanned is 15 seconds. A similar analysis applies for the other parameter classifications.

Section 4

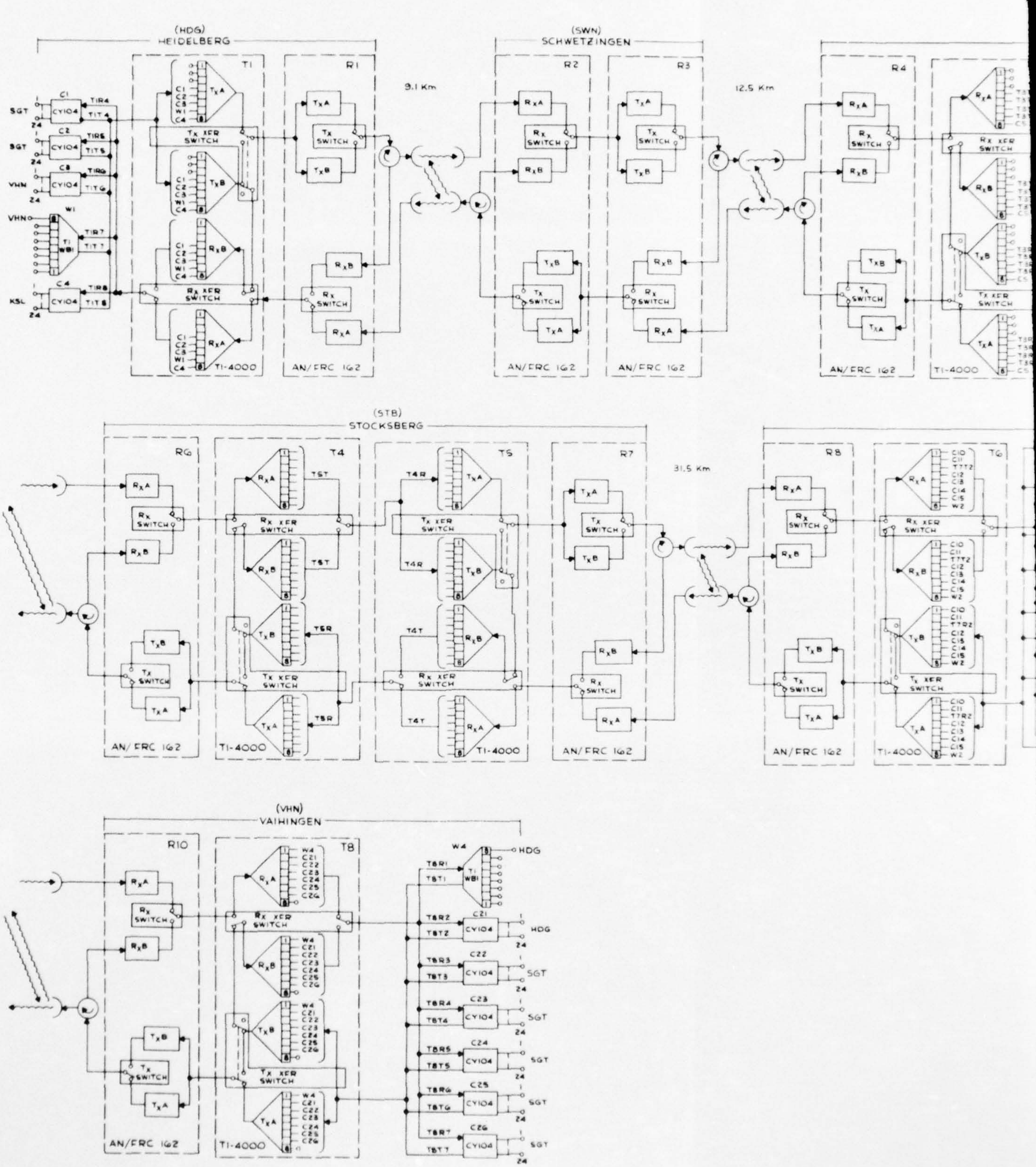
CONCLUSIONS

The ATEC Digital Adaptation Study sought to answer the questions: 1) What should be monitored for PA/FI/TA of the FKV system, 2) What measurements, data collection, and analysis should a monitor system perform, 3) Is the ATEC system and equipments applicable in satisfying the measurement and analysis requirements, either unmodified or with minor adaptations, and 4) Can an ATEC/FKV demonstration be performed? The study addressed each of these questions, in turn, and as can be seen from the preceeding information both in this Volume and in Volumes I and II of this report, the answer is that the ATEC system and equipments, augmented by minor hardware and software adaptations, can satisfy all the PA/FI/TA monitoring system requirements for the FKV digital transmission system. An ATEC monitoring system for the entire FKV system was presented and operational characteristics dealing with all aspects of the monitoring system were presented. In addition, an ATEC/FKV demonstration configuration was presented which would enable the validation of the ATEC digital transmission system monitoring capability through field testing and data collection on a link within the FKV system.

Appendix A

BLOCK DIAGRAMS

This appendix contains the following figures (the reference column lists the text page where the figure is referenced):



(HDG)
HEIDELBERG
(SWN)
SCHWETZINGEN
9.1 Km
12.5 Km
R1
R2
R3
R4
T1
SGT
VHN
KSL
CY104
TX XFR SWITCH
RX XFR SWITCH
TI-4000
AN/FRC 162
(STB)
STOCKSBERG
R6
T4
T5
R7
R8
T6
31.5 Km
(VHN)
VAIHINGEN
R10
T8
W4
HDG
C21
C22
C23
C24
C25
C26

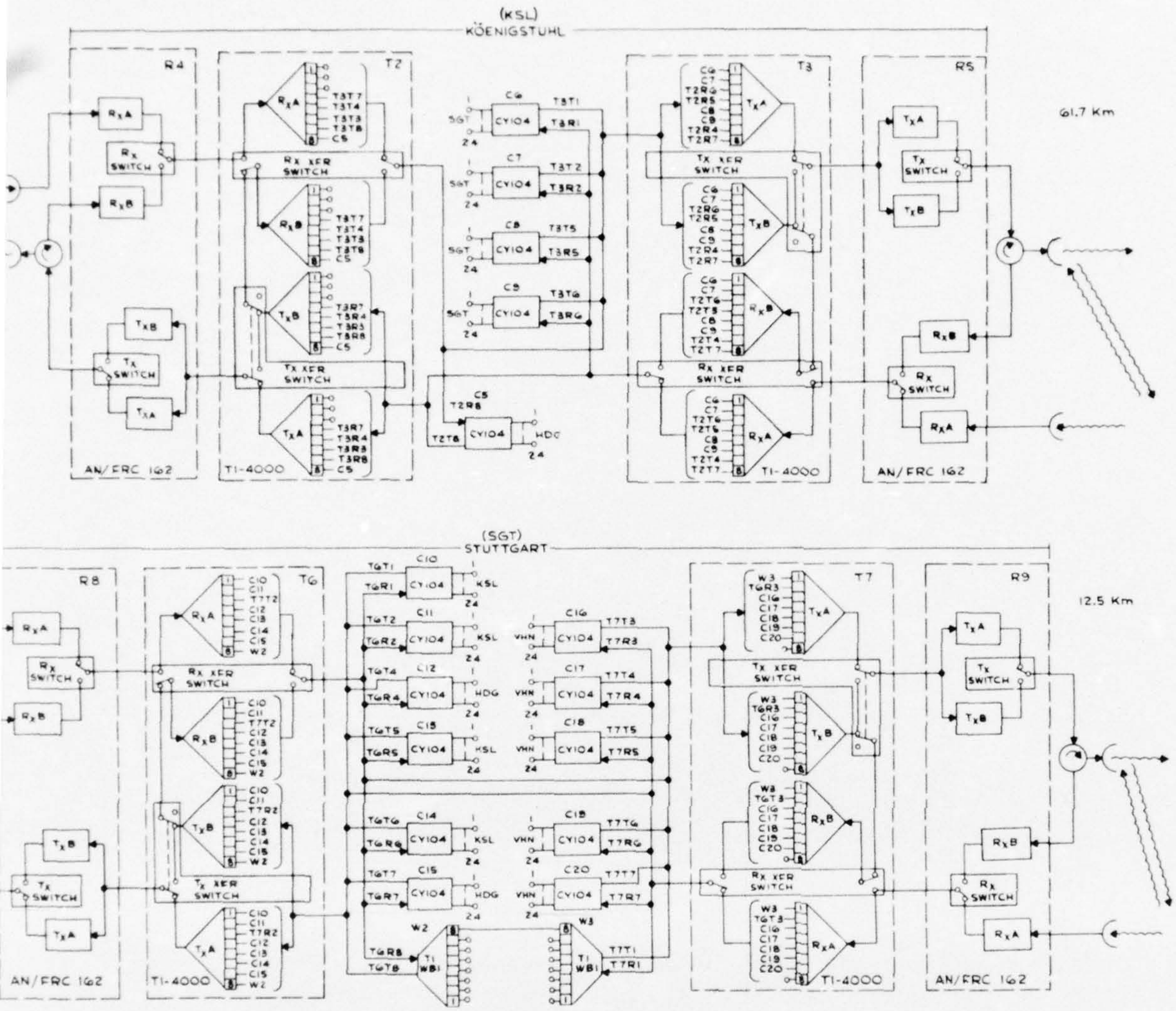
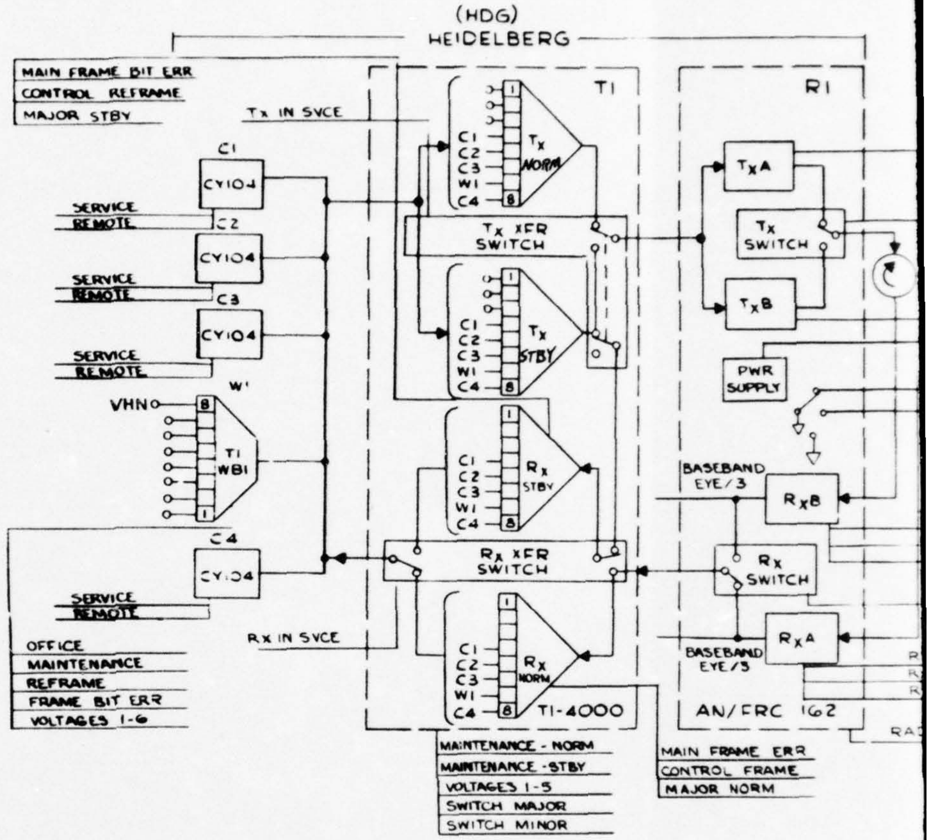


FIGURE 2-1. FKV SYSTEM DIAGRAM



ALARM SCANNER NO.1 (40 ALARMS)

R_x SQUELCH A/R1	• OFFICE/W1
R_x PROBLEM A/R1	MAINTENANCE/W1
R_x SQUELCH B/R1	R_x IN SERVICE/R1
R_x PROBLEM B/R1	T_x IN SERVICE/R1
• RADIO R_x	R_x IN SERVICE/T1
MAINTENANCE A/R1	T_x IN SERVICE/T1
MAINTENANCE B/R1	SPARE
T_x PROBLEM A/R1	
T_x PROBLEM B/R1	
MAJOR NORM/T1	
MAJOR STBY/T1	
• SWITCH MAJOR/T1	
SWITCH MINOR/T1	BATTERY CHARGER
MAINTENANCE NORM/T1	W.G. PRESSURE
MAINTENANCE STBY/T1	W.G. HUMIDITY
• SERVICE/C1	A.C. POWER
REMOTE C1	BATTERY STATUS
• SERVICE/C2	• SITE
REMOTE/C2	SPARE
• SERVICE/C3	SPARE
REMOTE/C3	SPARE
• SERVICE/C4	SPARE
REMOTE/C4	• SUDDEN SERVICE FAILURE SENSING SYSTEM

ANALOG SCANNER NO.1 (40 PARAMETERS)

RSL A/R1		* VOLTAGE 1/R1
RSL B/R1		* VOLTAGE 2/R1
EYE A-1/R1	BASEBAND MONITOR	* VOLTAGE 3/R1
EYE A-2/R1		* VOLTAGE 4/R1
EYE A-3/R1		* VOLTAGE 5/R1
EYE B-1/R1	PARAMETERS MEASURED BY BASEBAND MONITOR	* VOLTAGE 6/R1
EYE B-2/R1		* VOLTAGE 7/R1
EYE B-3/R1		* VOLTAGE 8/R1
MAIN FRAME BIT ERR NORM/T1		* VOLTAGE 1/T1
CONTROL REFRAME NORM/T1		* VOLTAGE 2/T1
MAIN FRAME BIT ERR STBY/T1		* VOLTAGE 3/T1
CONTROL REFRAME STBY/T1		* VOLTAGE 4/T1
R_x IN SERVICE/R1		* VOLTAGE 5/T1
R_x SQUELCH A/R1		* VOLTAGE 1/W1
R_x SQUELCH B/R1		* VOLTAGE 2/W1
R_x IN SERVICE/T1		* VOLTAGE 3/W1
FRAME BIT ERR/W1		* VOLTAGE 4/W1
REFRAME/W1		* VOLTAGE 5/W1
		* VOLTAGE 6/W1
		SPARE
		SPARE
		SPARE
		SPARE
		SPARE
		SPARE

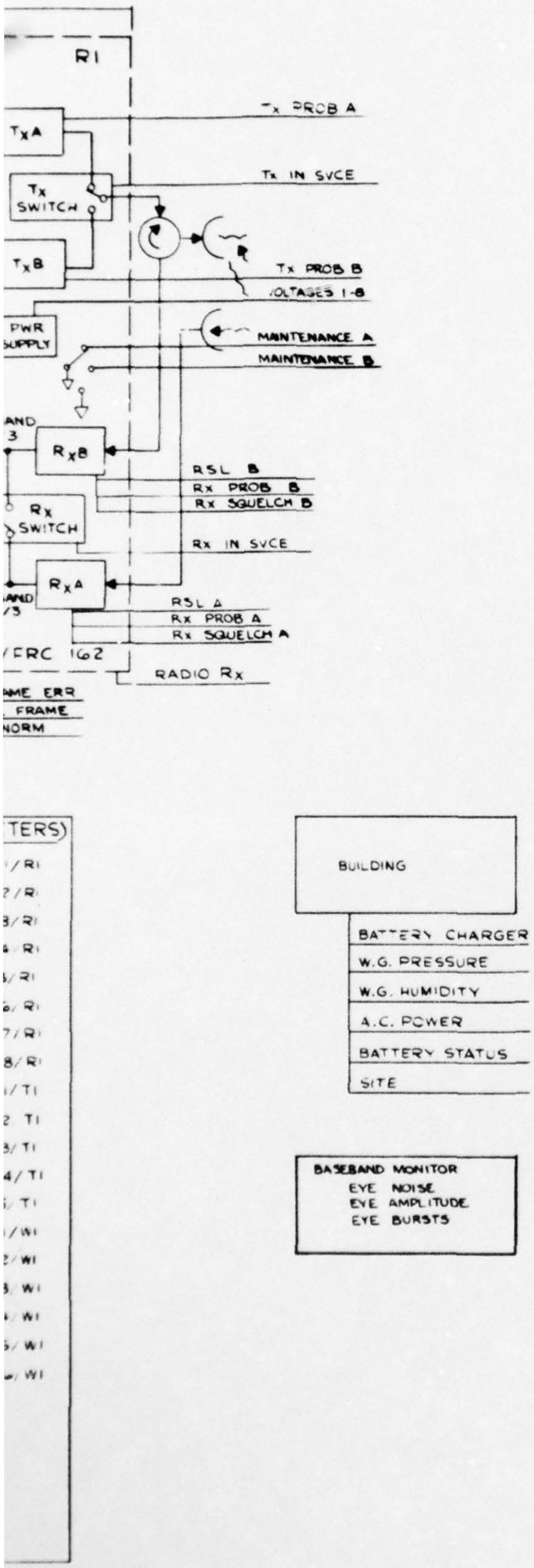
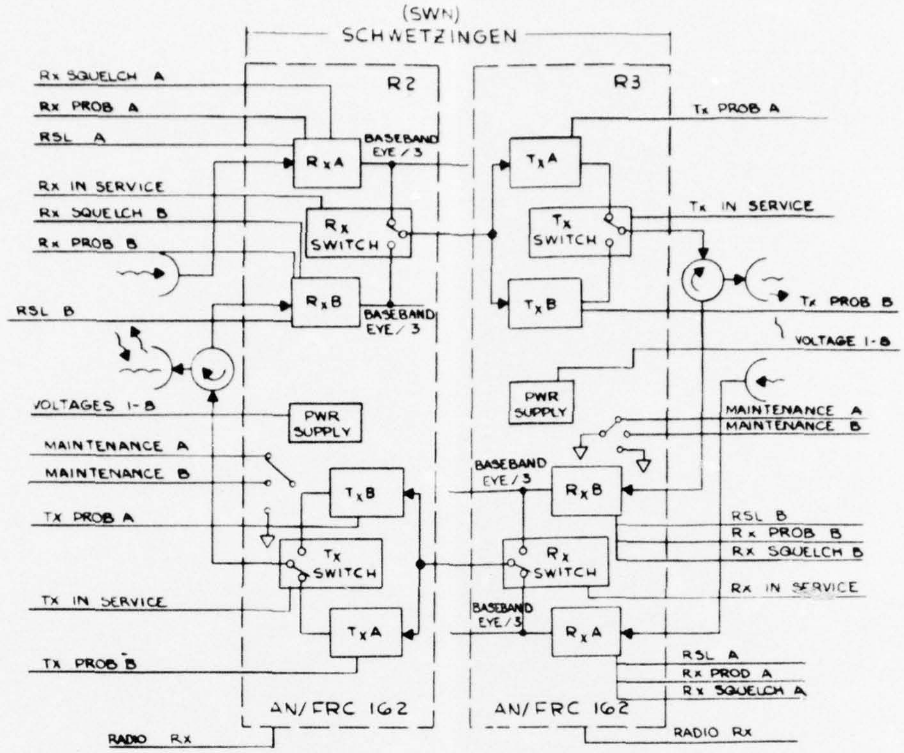


FIGURE 2-2. ALARM/ PARAMETER MONITOR POINT LIST HEIDELBERG



ALARM SCANNER NO 2
(40 ALARMS)

Rx SQUELCH A/R2
Rx PROBLEM A/R2
Rx SQUELCH B/R2
Rx PROBLEM B/R2
* RADIO Rx / R2
MAINTENANCE A/R2
MAINTENANCE B/R2
Tx PROBLEM A/R2
Tx PROBLEM B/R2
Rx SQUELCH A/R3
Rx PROBLEM A/R3
Rx SQUELCH B/R3
Rx PROBLEM B/R3
* RADIO Rx / R3
MAINTENANCE A/R3
MAINTENANCE B/R3
Tx PROBLEM A/R3
Tx PROBLEM B/R3
Rx IN SERVICE / R2
Tx IN SERVICE / R2
Rx IN SERVICE / R3
Tx IN SERVICE / R3
BATTERY CHARGER
ILLEGAL ENTRY
FIRE : GENERATOR
FIRE : BUILDING
WATER FLOOD
FUEL LEVEL
W.G. PRESSURE
W.G. HUMIDITY
TOWER LIGHTS
A.C. POWER
BATTERY STATUS
* SITE
SPARE
SPARE
SPARE
SPARE
SPARE
SPARE

* SUDDEN SERVICE FAILURE SENSING SYSTEM

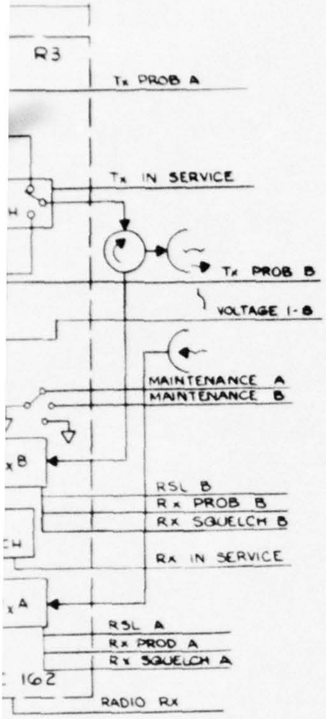
ANALOG SCANNER NO 2
(30 PARAMETERS)

RSL A / R2
RSL B / R2
EYE A-1 / R2
EYE A-2 / R2
EYE A-3 / R2
EYE B-1 / R2
EYE B-2 / R2
EYE B-3 / R2
Rx IN SERVICE / R2
Rx SQUELCH A / R2
Rx SQUELCH B / R2
RSL A / R3
RSL B / R3
EYE A-1 / R3
EYE A-2 / R3
EYE A-3 / R3
EYE B-1 / R3
EYE B-2 / R3
EYE B-3 / R3
Rx IN SERVICE / R3
Rx SQUELCH A / R3
Rx SQUELCH B / R3
VOLTAGE 1 / R2
VOLTAGE 2 / R2
VOLTAGE 3 / R2
VOLTAGE 4 / R2
VOLTAGE 5 / R2
VOLTAGE 6 / R2
VOLTAGE 7 / R2
VOLTAGE 8 / R2
VOLTAGE 1 / R3
VOLTAGE 2 / R3
VOLTAGE 3 / R3
VOLTAGE 4 / R3
VOLTAGE 5 / R3
VOLTAGE 6 / R3
VOLTAGE 7 / R3
VOLTAGE 8 / R3
SPARE

* OPTIONAL

BUILDING

BATTERY CHARGER
ILLEGAL ENTRY
FIRE : GENERATOR
FIRE : BUILDING
WATER FLOOD
FUEL LEVEL
W.G. PRESSURE
W.G. HUMIDITY
TOWER LIGHTS
A.C. POWER
BATTERY STATUS
SITE



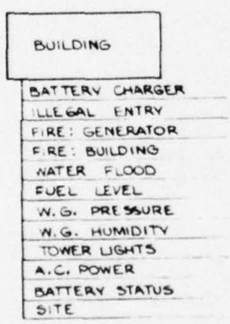
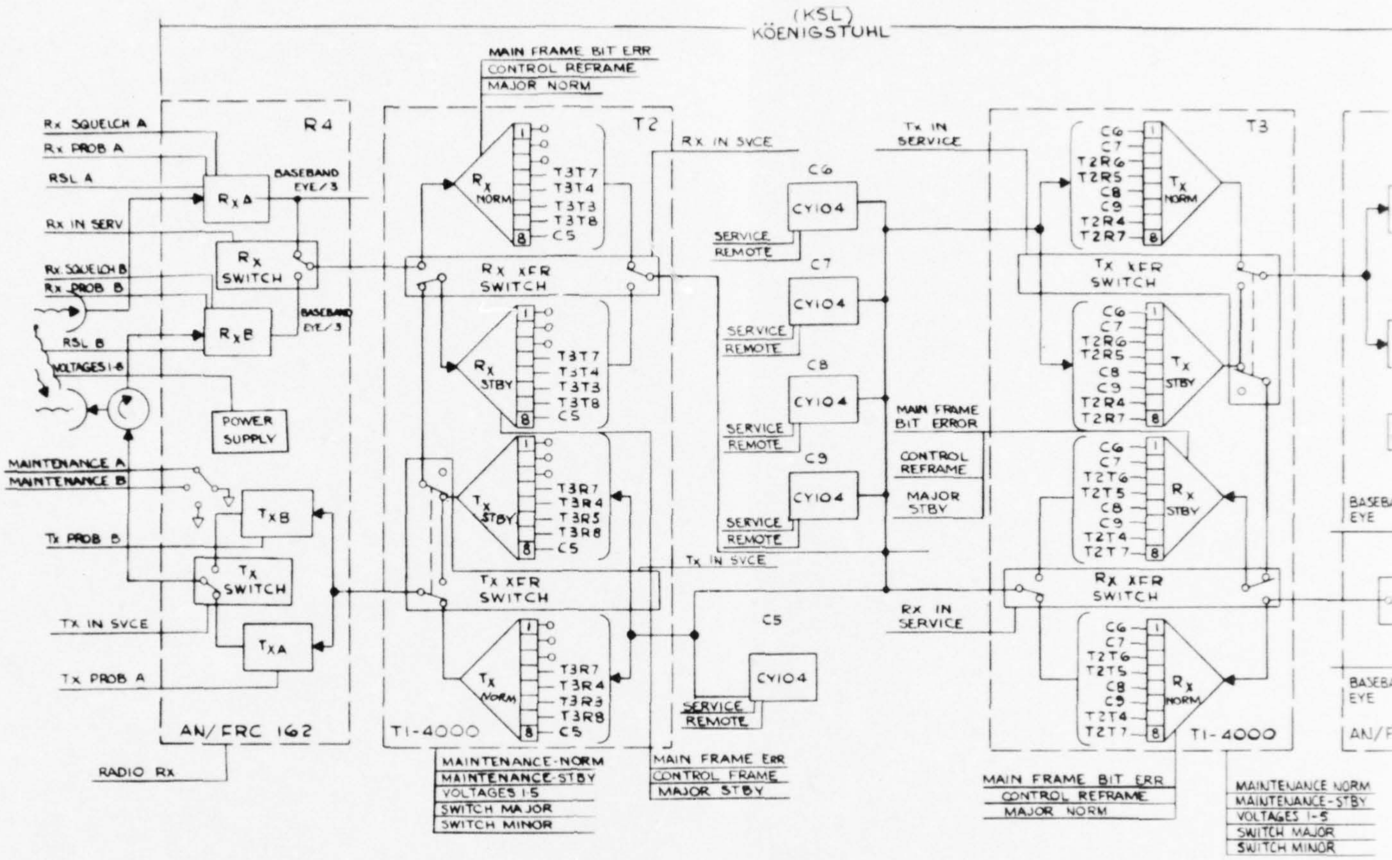


FIGURE 2-3. ALARM/
PARAMETER MONITOR POINT
LIST SCHWETZINGEN

2



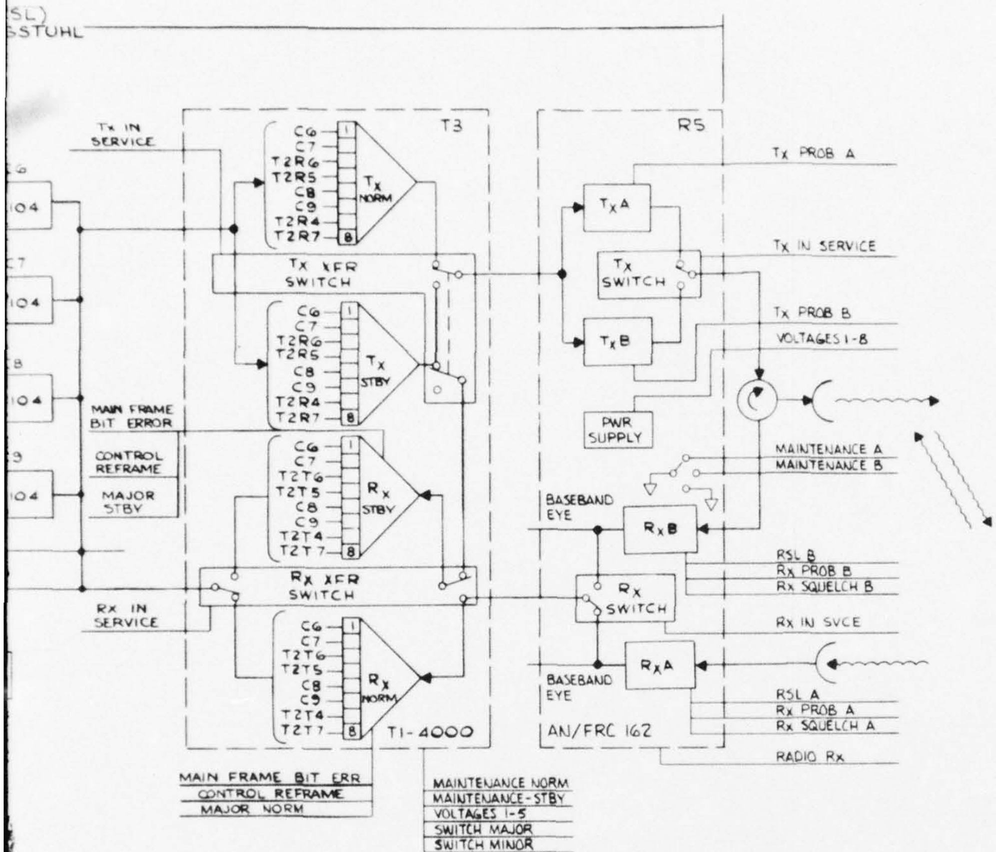
ALARM SCANNER NO. 3 (50 ALARMS)

R_X SQUELCH A/R4	● SERVICE /C9	BATTERY CHARGER
R_X PROBLEM A/R4	REMOTE /C9	DC/AC INVERTER
R_X SQUELCH B/R4	MAJOR STBY /T3	BATTERY STATUS
R_X PROBLEM B/R4	MAJOR NORM /T3	● SITE
● RADIO R_X /R4	● SWITCH MAJOR /T3	
MAINTENANCE A/R4	SWITCH MINOR /T3	
MAINTENANCE B/R4	MAINTENANCE NORM /T3	
T_X PROBLEM A/R4	MAINTENANCE STBY /T3	
T_X PROBLEM B/R4	R_X SQUELCH B/R5	
MAJOR NORM /T2	R_X PROBLEM B/R5	
MAJOR STBY /T2	R_X SQUELCH A/R5	
● SWITCH MAJOR /T2	R_X PROBLEM A/R5	
SWITCH MINOR /T2	● RADIO R_X /R5	
MAINTENANCE NORM /T2	MAINTENANCE A/R5	
MAINTENANCE STBY /T2	MAINTENANCE B/R5	
● SERVICE /C5	R_X IN SERVICE /T4	
REMOTE /C5	T_X IN SERVICE/T4	
● SERVICE /C6	R_X IN SERVICE /T2	
REMOTE /C6	T_X IN SERVICE/T2	
● SERVICE /C7	R_X IN SERVICE/R3	
REMOTE /C7	T_X IN SERVICE/R3	
● SERVICE /C8	R_X IN SERVICE/R5	
REMOTE /C8	T_X IN SERVICE/R5	

● SUDDEN SERVICE FAILURE SENSING SYSTEM

ANALOG SCANNER NO. 3 & 4

RSL A/R4		MAIN FRAME B
RSL B/R4		CONTROL REF
EYE A-1/R4	BASEBAND MONITOR	R_X IN SERVICE
EYE A-2/R4		R_X SQUELCH
EYE A-3/R4		R_X SQUELCH
EYE B-1/R4	PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR	R_X IN SERVIC
EYE B-2/R4		● VOLTAGE 1/R
EYE B-3/R4		● VOLTAGE 2/R
MAIN FRAME BIT ERR NORM/T2		● VOLTAGE 3/R
CONTROL REFRAME NORM/T2		● VOLTAGE 4/R
MAIN FRAME BIT ERR STBY/T2		● VOLTAGE 5/R
CONTROL REFRAME STBY/T2		● VOLTAGE 6/R
R_X IN SERVICE/R4		● VOLTAGE 7/R
R_X SQUELCH A/R4		● VOLTAGE 8/R
R_X SQUELCH B/R4		● VOLTAGE 1/T2
R_X IN SERVICE/T2		● VOLTAGE 2/T2
RSL A/R5		● VOLTAGE 3/T2
RSL B/R5		● VOLTAGE 4/T
EYE A-1/R5	PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR	● VOLTAGE 5/T2
EYE A-2/R5		● VOLTAGE 1/T3
EYE A-3/R5		● VOLTAGE 2/T
EYE B-1/R5	PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR	● VOLTAGE 3/T
EYE B-2/R5		● VOLTAGE 4/T
EYE B-3/R5		● VOLTAGE 5/T
MAIN FRAME BIT ERR NORM/T3		● VOLTAGE 1/R
CONTROL REFRAME NORM/T3		● VOLTAGE 2/R



ANALOG SCANNER NO. 3 & 4 (60 PARAMETERS)

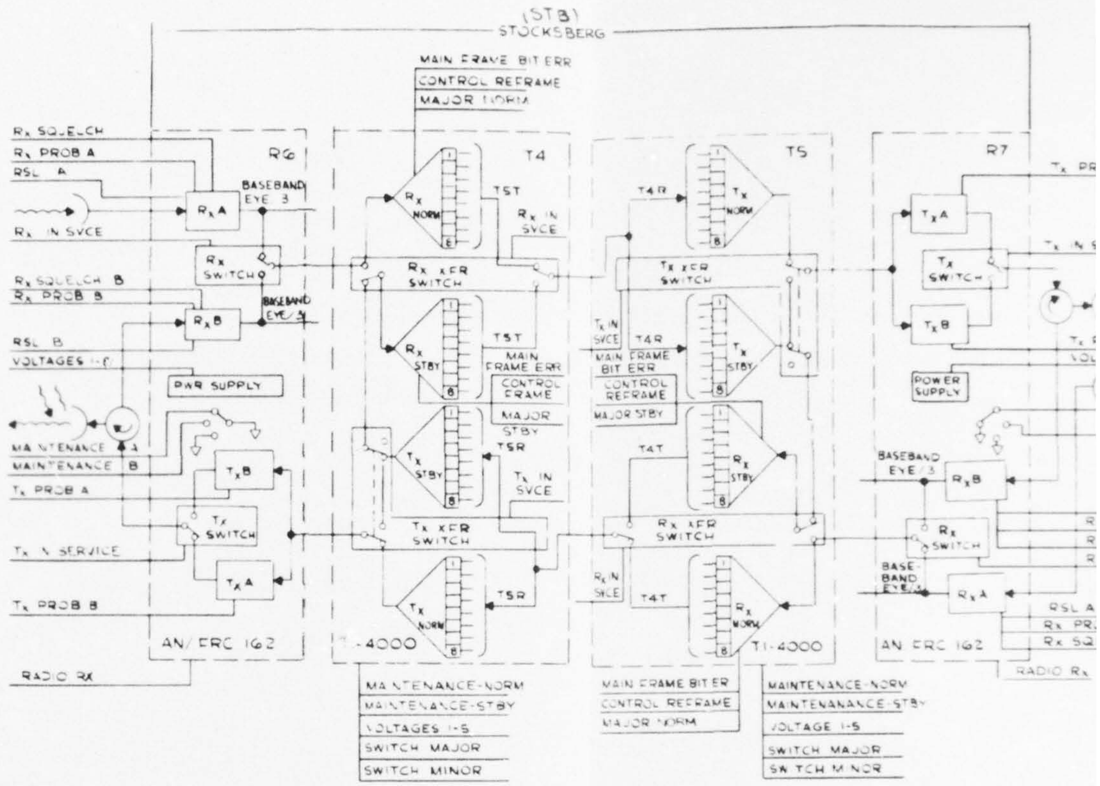
RSL A/R4		MAIN FRAME BIT ERR STBY/T3		* VOLTAGE 3/R5
RSL B/R4		CONTROL REFRAME STBY/T3		* VOLTAGE 4/R5
EYE A-1/R4		Rx IN SERVICE/R5		* VOLTAGE 5/R5
EYE A-2/R4	BASEBAND MONITOR	Rx SQUELCH A/R5		* VOLTAGE 6/R5
EYE A-3/R4		Rx SQUELCH B/R5		* VOLTAGE 7/R5
EYE B-1/R4		Rx IN SERVICE/T3		* VOLTAGE 8/R5
EYE B-2/R4	PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR	* VOLTAGE 1/R4		W.G. PRESSURE
EYE B-3/R4		* VOLTAGE 2/R4		W.G. HUMIDITY
MAIN FRAME BIT ERR NORM/T2		* VOLTAGE 3/R4		TOWER LIGHTS
CONTROL REFRAME NORM/T2		* VOLTAGE 4/R4		A.C. POWER
MAIN FRAME BIT ERR STBY/T2		* VOLTAGE 5/R4		SPARE
CONTROL REFRAME STBY/T2		* VOLTAGE 6/R4		SPARE
Rx IN SERVICE/R4		* VOLTAGE 7/R4		SPARE
Rx SQUELCH A/R4		* VOLTAGE 8/R4		SPARE
Rx SQUELCH B/R4		* VOLTAGE 1/T2		SPARE
Rx IN SERVICE/T2		* VOLTAGE 2/T2		SPARE
RSL A/R5		* VOLTAGE 3/T2		SPARE
RSL B/R5		* VOLTAGE 4/T2		
EYE A-1/R5		* VOLTAGE 6/T2		
EYE A-2/R5	PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR	* VOLTAGE 1/T3		
EYE A-3/R5		* VOLTAGE 2/T3		
EYE B-1/R5		* VOLTAGE 3/T3	* OPTIONAL	
EYE B-2/R5	PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR	* VOLTAGE 4/T3		
EYE B-3/R5		* VOLTAGE 5/T3		
MAIN FRAME BIT ERR NORM/T3		* VOLTAGE 1/R5		
CONTROL REFRAME NORM/T3		* VOLTAGE 2/R5		

BUILDING

- BATTERY CHARGER
- DC/AC INVERTER
- W.G. PRESSURE
- W.G. HUMIDITY
- TOWER LIGHTS
- A.C. POWER
- BATTERY STATUS
- SITE

BASEBAND MONITOR
- EYE NOISE
- EYE AMPLITUDE
- EYE BURSTS

FIGURE 2-4. ALARM/PARAMETER MONITOR POINT LIST KOENIGSTUHL



ALARM SCANNER NO 4 (50 ALARMS)

Rx SQUELCH A / R6
Rx PROBLEM A / R6
Rx SQUELCH B / R6
Rx PROBLEM B / R6
• RADIO Rx / R6
MAINTENANCE A / R6
MAINTENANCE B / R6
Tx PROBLEM A / R6
Tx PROBLEM B / R6
MAJOR NORM / T4
MAJOR STBY / T4
• SWITCH MAJOR / T4
SWITCH MINOR / T4
MAINTENANCE NORM / T4
MAINTENANCE STBY / T4
Rx SQUELCH A / R7
Rx PROBLEM A / R7
Rx SQUELCH B / R7
Rx PROBLEM B / R7
• RADIO Rx / R7
MAINTENANCE A / R7
MAINTENANCE B / R7
Tx PROBLEM A / R7
Tx PROBLEM B / R7
MAJOR NORM / T5
MAJOR STBY / T5
• SWITCH MAJOR / T5
SWITCH MINOR / T5
MAINTENANCE NORM / T5
MAINTENANCE STBY / T5
Rx IN SERVICE / R6
Tx IN SERVICE / R6
Rx IN SERVICE / T4
Tx IN SERVICE / T4
Rx IN SERVICE / R7
Tx IN SERVICE / R7
Rx IN SERVICE / T5
Tx IN SERVICE / T5

BATTERY CHARGER
ILLEGAL ENTRY
FIRE : GENERATOR
FIRE : BUILDING
WATER FLOOD
FUEL LEVEL
W.G. PRESSURE
W.G. HUMIDITY
TOWER LIGHTS
A.C. POWER
BATTERY STATUS
• SITE

• SUDDEN SERVICE FAILURE SENSING SYSTEM

ANALOG SCANNER NO 5&6 (50 PARAMETERS)

RSL A / R6
RSL B / R6
EYE A-1 / R6 }
EYE A-2 / R6 } BASEBAND MONITOR
EYE A-3 / R6 }
EYE B-1 / R6 }
EYE B-2 / R6 } PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR
EYE B-3 / R6 }
MAIN FRAME BIT ERR NORM / T4
CONTROL REFRAME NORM / T4
MAIN FRAME BIT ERR STBY / T4
CONTROL REFRAME STBY / T4
Rx IN SERVICE R4
Rx SQUELCH A / R4
Rx SQUELCH B / R4
Rx IN SERVICE / T4
RSL A / R7
RSL B / R7
EYE A-1 / R7 }
EYE A-2 / R7 } PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR
EYE A-3 / R7 }
EYE B-1 / R7 }
EYE B-2 / R7 } PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR
EYE B-3 / R7 }
MAIN FRAME BIT ERR NORM / T5
CONTROL REFRANE NORM / T5
MAIN FRAME BIT ERR STBY / T5
CONTROL REFRAME STBY / T5
Rx IN SERVICE / R7
Rx SQUELCH A / R7
Rx SQUELCH B / R7
Rx IN SERVICE / T5
* VOLTAGE 1 / R6
* VOLTAGE 2 / R6
* VOLTAGE 3 / R6
* VOLTAGE 4 / R6
* VOLTAGE 5 / R6
* VOLTAGE 6 / R6
* VOLTAGE 7 / R6
* VOLTAGE 8 / R6

* VOLTAGE 1 / T4
* VOLTAGE 2 / T4
* VOLTAGE 3 / T4
* VOLTAGE 4 / T4
* VOLTAGE 5 / T4
* VOLTAGE 1 / R7
* VOLTAGE 2 / R7
* VOLTAGE 3 / R7
* VOLTAGE 4 / R7
* VOLTAGE 5 / R7
* VOLTAGE 6 / R7
* VOLTAGE 7 / R7
* VOLTAGE 8 / R7
* VOLTAGE 1 / T5
* VOLTAGE 2 / T5
* VOLTAGE 3 / T5
* VOLTAGE 4 / T5
* VOLTAGE 5 / T5
SPARE

* OPTIONAL

AD-A033 716 HONEYWELL INC ST PETERSBURG FLA AEROSPACE DIV F/G 17/2
ATEC DIGITAL ADAPTATION STUDY. VOLUME III. SUMMARY AND RECOMMEN--ETC(U)
OCT 76 T R ARMSTRONG, A K BLOUGH JR. F30602-75-C-0282
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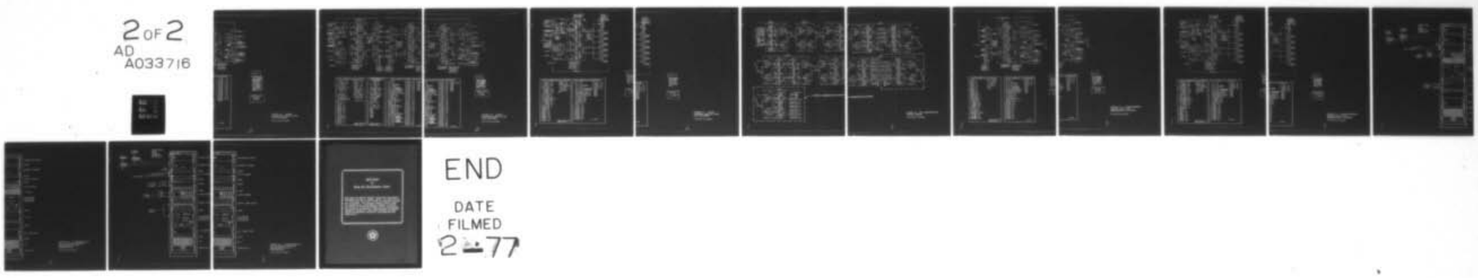

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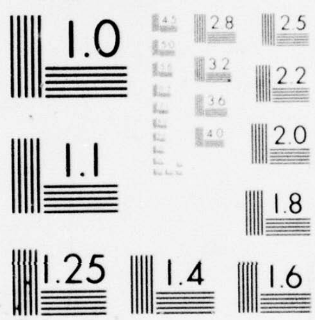
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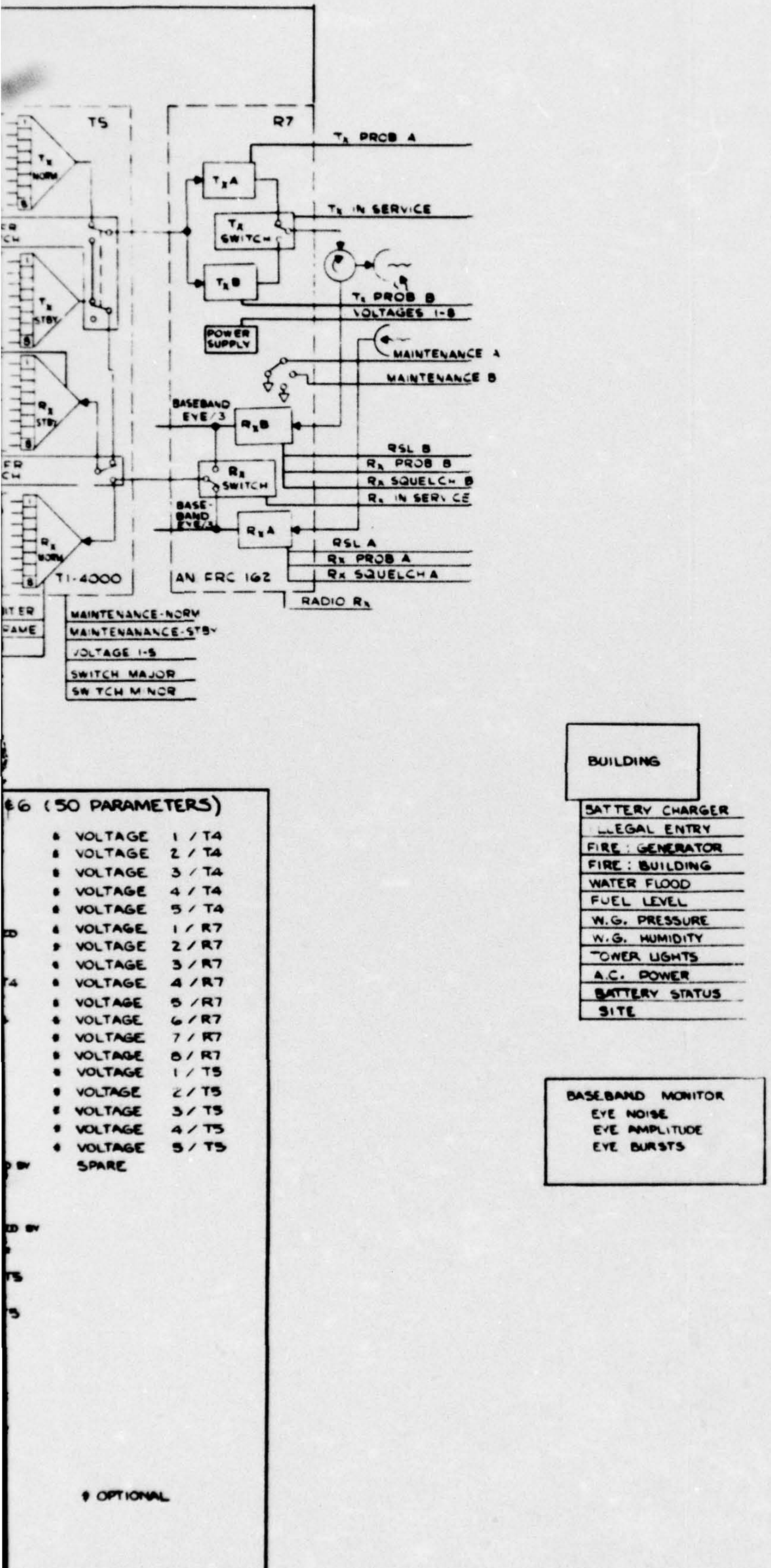
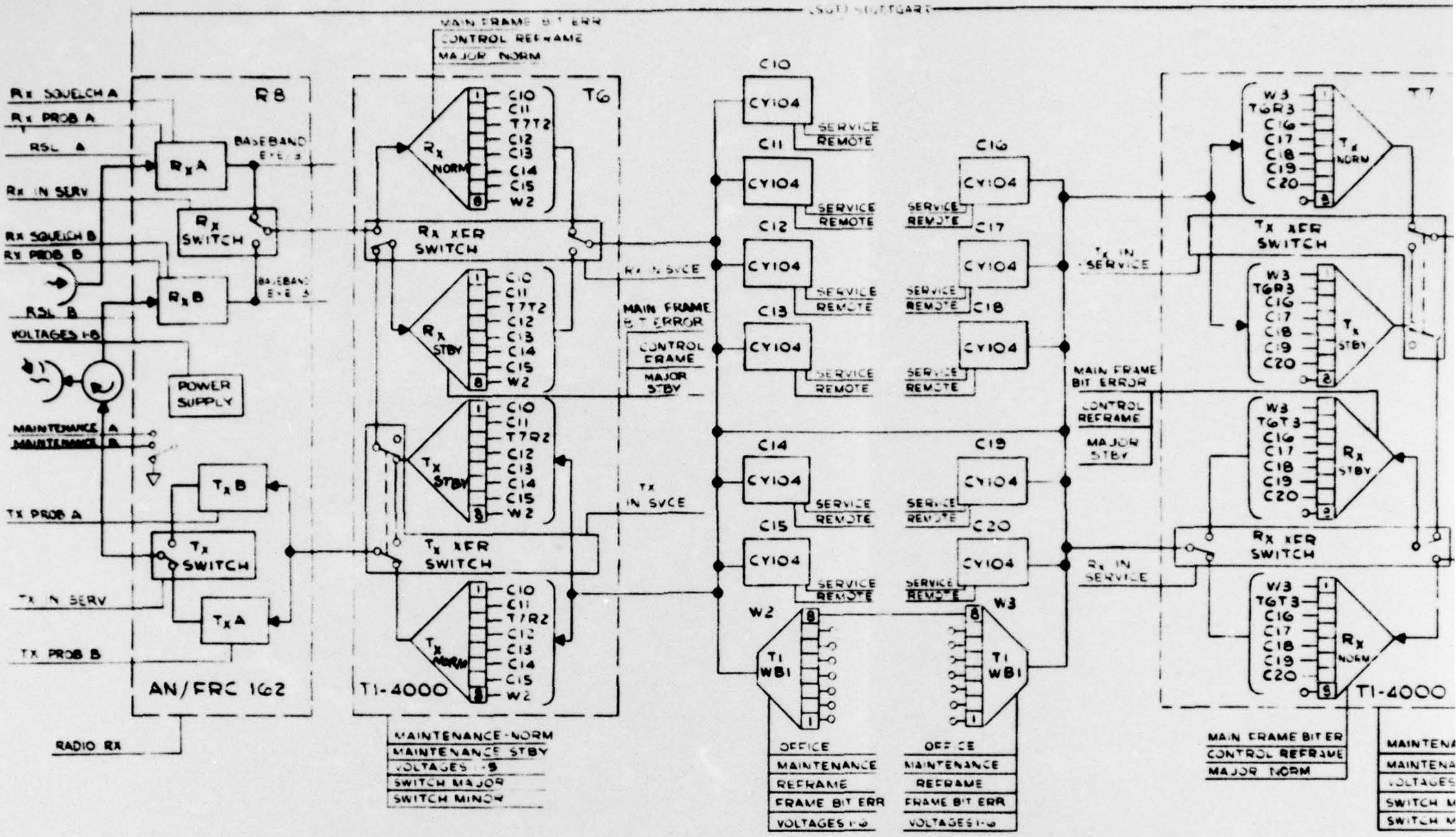


FIGURE 2-5. ALARM/ PARAMETERS MONITOR POINT LIST STOCKSBERG

2



ALARM SCANNER NO5 (50 ALARMS)

Rx SQUELCH A/R8
Rx PROB A/R8
Rx SQUELCH B/R8
Rx PROB B/R8
• RADIO Rx/R8
MAINTENANCE A/R8
MAINTENANCE B/R8
Tx PROB A/R8
Tx PROB B/R8

MAJOR-NORM/T6
MAJOR-STBY/T6
• SWITCH MAJOR/T6
SWITCH MINOR/T6
MAINTENANCE-NORM/T6
MAINTENANCE-STBY/T6
• SERVICE/C10
REMOTE/C10
• SERVICE/C11
REMOTE/C11
• SERVICE/C12
REMOTE/C12
• SERVICE/C13
REMOTE/C13
• SERVICE/C14
REMOTE/C14
• SERVICE/C15
REMOTE/C15
• OFFICE/W2
MAINTENANCE/W2
REFRAME/W2
• SERVICE/C16
REMOTE/C16
• SERVICE/C17
REMOTE/C17

• SERVICE/C18
REMOTE/C18
• SERVICE/C19
REMOTE/C19
• SERVICE/C20
REMOTE/C20
• OFFICE/W3
MAINTENANCE/W3
REFRAME/W3
MAJOR STBY/T7
MAJOR NORM/T7
• SWITCH MAJOR/T7
SWITCH MINOR/T7
Tx PROB A/R9
Tx PROB B/R9

Rx SQUELCH B/R9

• SUDDEN SERVICE FAILURE SENSING SYSTEM

ALARM SCANNER NO6 (30 ALARMS)

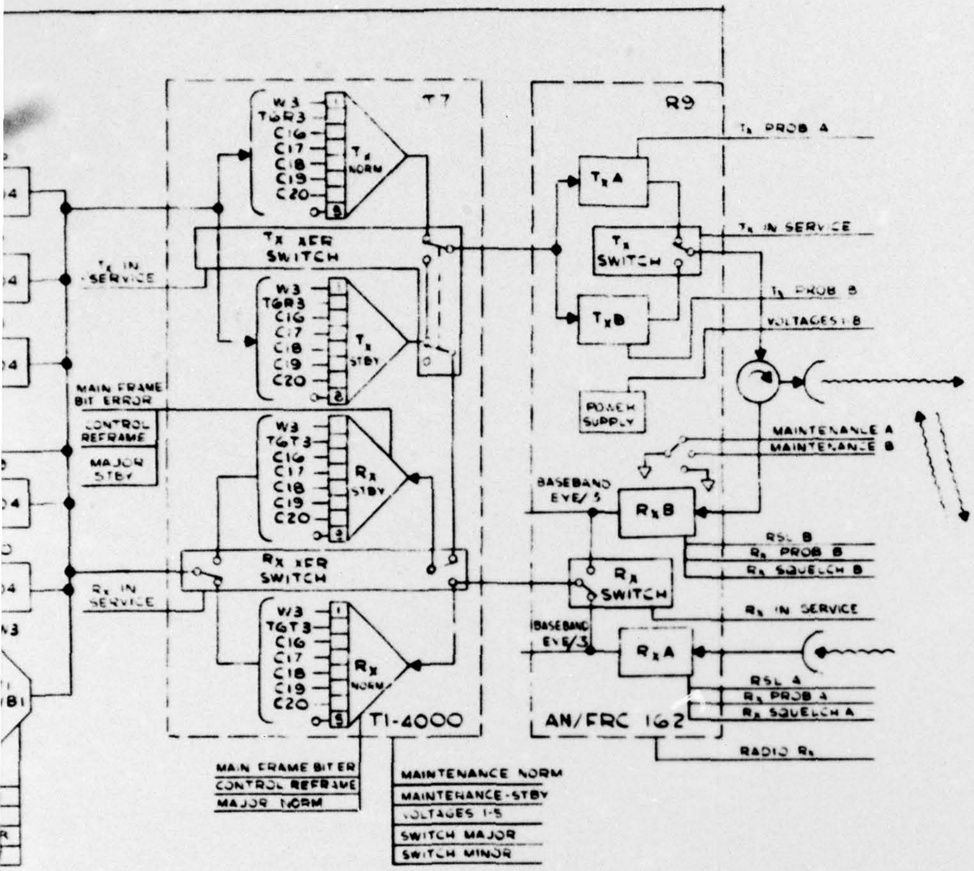
Rx IN SERV/R8
Tx IN SERV/R8
Rx IN SERV/T6
Tx IN SERV/T6
Tx IN SERV/T7
Rx IN SERV/T7
MAINTENANCE-NORM/T7
MAINTENANCE-STBY/T7
Tx IN SERV/R9
Rx IN SERV/R9
MAINTENANCE A/R9
MAINTENANCE B/R9
BATTERY CHARGER
DC/AC INVERTER
W.G. PRESSURE
W.G. HUMIDITY
AC POWER
BATTERY STATUS
• SITE
Rx PROB B/R9
Rx PROB A/R9
Rx SQUELCH A/R9
• RADIO Rx/R9
SPARE
SPARE
SPARE
SPARE
SPARE
SPARE
SPARE

• SUDDEN SERVICE FAILURE SENSING SYSTEM

ANALOG SCANNER NO7&8 (80 PARAMETERS)

RSL A/R8		#VOLTAGE 1/R8	#VOLTAGE
RSL B/R8		#VOLTAGE 2/R8	#VOLTAGE
EYE A-1/R8	BASEBAND MONITOR	#VOLTAGE 3/R8	SPARE
EYE A-2/R8		#VOLTAGE 4/R8	SPARE
EYE A-3/R8		#VOLTAGE 5/R8	SPARE
EYE B-1/R8	PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR	#VOLTAGE 6/R8	SPARE
EYE B-2/R8		#VOLTAGE 7/R8	SPARE
EYE B-3/R8		#VOLTAGE 8/R8	SPARE
MAIN FRAME BIT ERR NORM/T6		#VOLTAGE 1/T6	
CONTROL REFRAME NORM/T6		#VOLTAGE 2/T6	
MAIN FRAME BIT ERR STBY/T6		#VOLTAGE 3/T6	
Rx IN SERVICE/R8		#VOLTAGE 4/T6	
Rx SQUELCH A/R8		#VOLTAGE 5/T6	
Rx SQUELCH B/R8		#VOLTAGE 1/W2	
Rx IN SERVICE/T6		#VOLTAGE 2/W2	
CONTROL REFRAME STBY/T6		#VOLTAGE 3/W2	
FRAME BIT ERROR/W2		#VOLTAGE 4/W2	
REFRAME/W2		#VOLTAGE 5/W2	
REFRAME/W3		#VOLTAGE 6/W2	
FRAME BIT ERROR/W3		#VOLTAGE 1/W3	
MAIN FRAME BIT ERR STBY/T7		#VOLTAGE 2/W3	
CONTROL REFRAME STBY/T7		#VOLTAGE 3/W3	
Rx IN SERVICE/T7		#VOLTAGE 4/W3	
Rx SQUELCH B/R9		#VOLTAGE 5/W3	
Rx SQUELCH A/R9		#VOLTAGE 6/W3	
Rx IN SERVICE/R9		#VOLTAGE 1/T7	
MAIN FRAME BIT ERR NORM/T7		#VOLTAGE 2/T7	
CONTROL REFRAME NORM/T7		#VOLTAGE 3/T7	
EYE B-1/R9	PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR	#VOLTAGE 4/T7	
EYE B-2/R9		#VOLTAGE 5/T7	
EYE B-3/R9		#VOLTAGE 1/R9	
EYE A-1/R9	PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR	#VOLTAGE 2/R9	
EYE A-2/R9		#VOLTAGE 3/R9	
EYE A-3/R9		#VOLTAGE 4/R9	
RSL B/R9		#VOLTAGE 5/R9	
RSL A/R9		#VOLTAGE 6/R9	

#OPTIO



NALOG SCANNER NO 7&8 (80 PARAMETERS)

A/R8	#VOLTAGE 1/R8	#VOLTAGE 7/R9
B/R8	#VOLTAGE 2/R8	#VOLTAGE 8/R9
A-1/R8 } BASEBAND MONITOR	#VOLTAGE 3/R8	SPARE
A-2/R8	#VOLTAGE 4/R8	SPARE
A-3/R8	#VOLTAGE 5/R8	SPARE
B-1/R8 } PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR	#VOLTAGE 6/R8	SPARE
B-2/R8	#VOLTAGE 7/R8	SPARE
B-3/R8	#VOLTAGE 8/R8	SPARE
FRAME BIT ERR NORM/T6	#VOLTAGE 1/T6	
OL REFRAME NORM/T6	#VOLTAGE 2/T6	
FRAME BIT ERR STBY/T6	#VOLTAGE 3/T6	
SERVICE /R8	#VOLTAGE 4/T6	
QUELCH A /R8	#VOLTAGE 5/T6	
QUELCH B /R8	#VOLTAGE 1/W2	
SERVICE/ T6	#VOLTAGE 2/W2	
OL REFRAME STBY / T6	#VOLTAGE 3/W2	
E BIT ERROR /W2	#VOLTAGE 4/W2	
ME /W2	#VOLTAGE 5/W2	
ME /W3	#VOLTAGE 6/W2	
. BIT ERROR/W3	#VOLTAGE 1/W3	
FRAME BIT ERR STBY/T7	#VOLTAGE 2/W3	
OL REFRAME STBY/T7	#VOLTAGE 3/W3	
SERVICE /T7	#VOLTAGE 4/W3	
QUELCH B /R9	#VOLTAGE 5/W3	
QUELCH A/ R9	#VOLTAGE 6/W3	
SERVICE /R9	#VOLTAGE 1/T7	
RAME BIT ERR NORM/T7	#VOLTAGE 2/T7	
OL REFRAME NORM/T7	#VOLTAGE 3/T7	
B-1/R9 } PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR	#VOLTAGE 4/T7	
B-2/R9	#VOLTAGE 5/T7	
B-3/R9	#VOLTAGE 1/R9	
A-1/R9 } PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR	#VOLTAGE 2/R9	
A-2/R9	#VOLTAGE 3/R9	
A-3/R9	#VOLTAGE 4/R9	
B/R9	#VOLTAGE 5/R9	
A/R9	#VOLTAGE 6/R9	

OPTIONAL

BUILDING

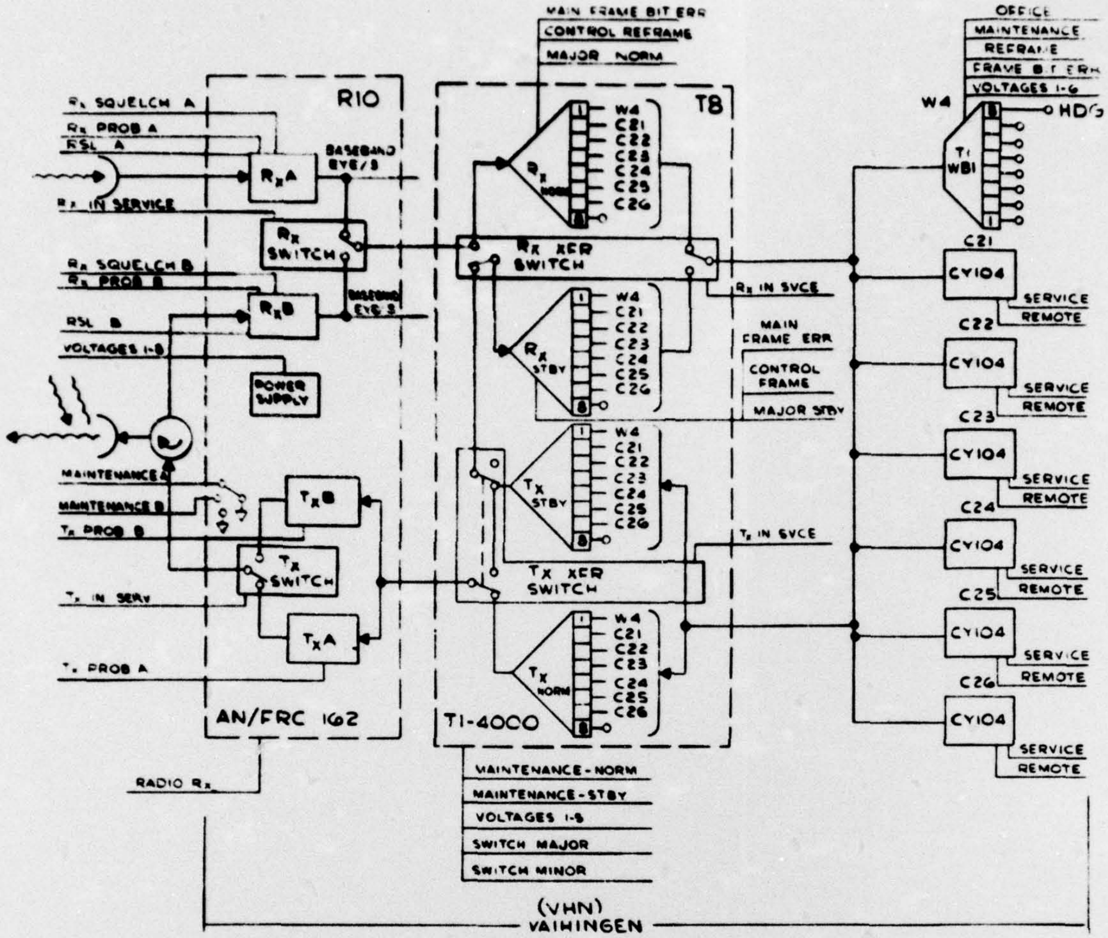
- BATTERY CHARGER
- DC/AC INVERTER
- W.G. PRESSURE
- W.G. HUMIDITY
- A.C. POWER
- BATTERY STATUS
- SITE

BASEBAND MONITOR

- EYE NOISE
- EYE AMPL
- EYE BURSTS

FIGURE 2-6. ALARM/ PARAMETER MONITOR POINT LIST STUTTGART

2



BUILDING

BATTERY CH
W.G. PRESS
W.G. HUMID
TOWER LIGH
A.C. POWE
BATTERY S
SITE

BASEBAND MO
EYE NOISE
EYE AMPL
EYE BURS

ALARM SCANNER NO 2 (40 ALARMS)

Rx SQUELCH A/RIO
Rx PROBLEM A/RIO
Rx SQUELCH B/RIO
Rx PROBLEM B/RIO
• RADIO Rx/RIO
MAINTENANCE A/RIO
MAINTENANCE B/RIO
Tx PROBLEM A/RIO
Tx PROBLEM B/RIO
MAJOR NORM/T8
MAJOR STBY/T8
• SWITCH MAJOR/T8
SWITCH MINOR/T8
MAINTENANCE NORM/T8
MAINTENANCE STBY/T8
Rx IN SERVICE/RIO
Tx IN SERVICE/RIO
Rx IN SERVICE/T8
Tx IN SERVICE/T8
• OFFICE/W4
MAINTENANCE/W4
REFRAME/W4
• SERVICE/C21
REMOTE/C21
• SERVICE/C22
REMOTE/C22
• SERVICE/C23
REMOTE/C23
• SERVICE/C24
REMOTE/C24
• SERVICE/C25
REMOTE/C25
• SERVICE/C26
REMOTE/C26
BATTERY CHARGER
W.G. PRESSURE } OR'D
W.G. HUMIDITY }
TOWER LIGHTS
A.C. POWER
BATTERY STATUS
• SITE

• SUDDEN SERVICE FAILURE SENSING SYSTEM

ANALOG SCANNER NO 2 (40 PARAMETERS)

RSL A/RIO
RSL B/RIO
EYE A-1/RIO } BASEBAND MONITOR
EYE A-2/RIO }
EYE A-3/RIO }
EYE B-1/RIO } PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR
EYE B-2/RIO }
EYE B-3/RIO }
MAIN FRAME BIT ERR NORM/T8
CONTROL REFRAME NORM/T8
MAIN FRAME BIT ERR STBY/T8
CONTROL REFRAME STBY/T8
Rx IN SERVICE/RIO
Rx SQUELCH A/RIO
Rx SQUELCH B/RIO
Rx IN SERVICE/T8
FRAME BIT ERR/W4
REFRAME/W4
◆ VOLTAGE 1/RIO
◆ VOLTAGE 2/RIO
◆ VOLTAGE 3/RIO
◆ VOLTAGE 4/RIO
◆ VOLTAGE 5/RIO
◆ VOLTAGE 6/RIO
◆ VOLTAGE 7/RIO
◆ VOLTAGE 8/RIO
◆ VOLTAGE 1/T2
◆ VOLTAGE 2/T2
◆ VOLTAGE 3/T2
◆ VOLTAGE 4/T2
◆ VOLTAGE 5/T2
◆ VOLTAGE 1/W4
◆ VOLTAGE 2/W4
◆ VOLTAGE 3/W4
◆ VOLTAGE 4/W4
◆ VOLTAGE 5/W4
◆ VOLTAGE 6/W4
SPARE
SPARE
SPARE
SPARE
SPARE
SPARE

◆ OPTIONAL

1

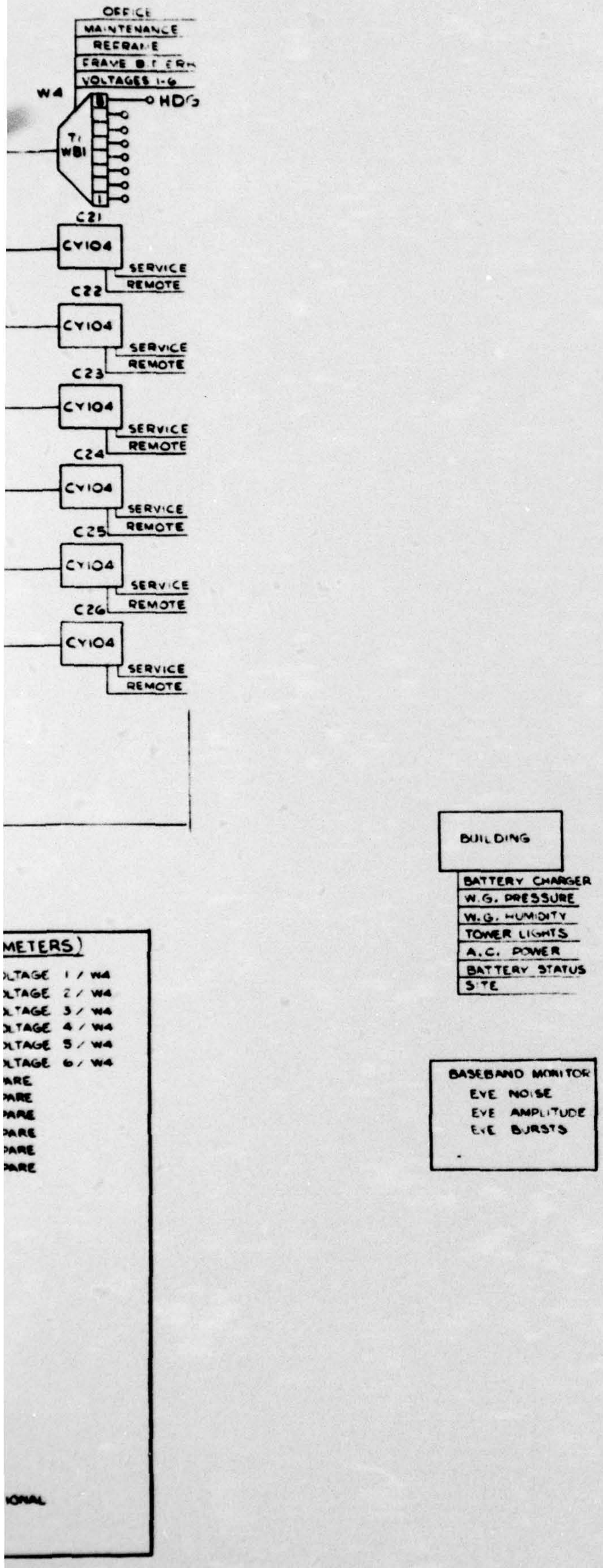
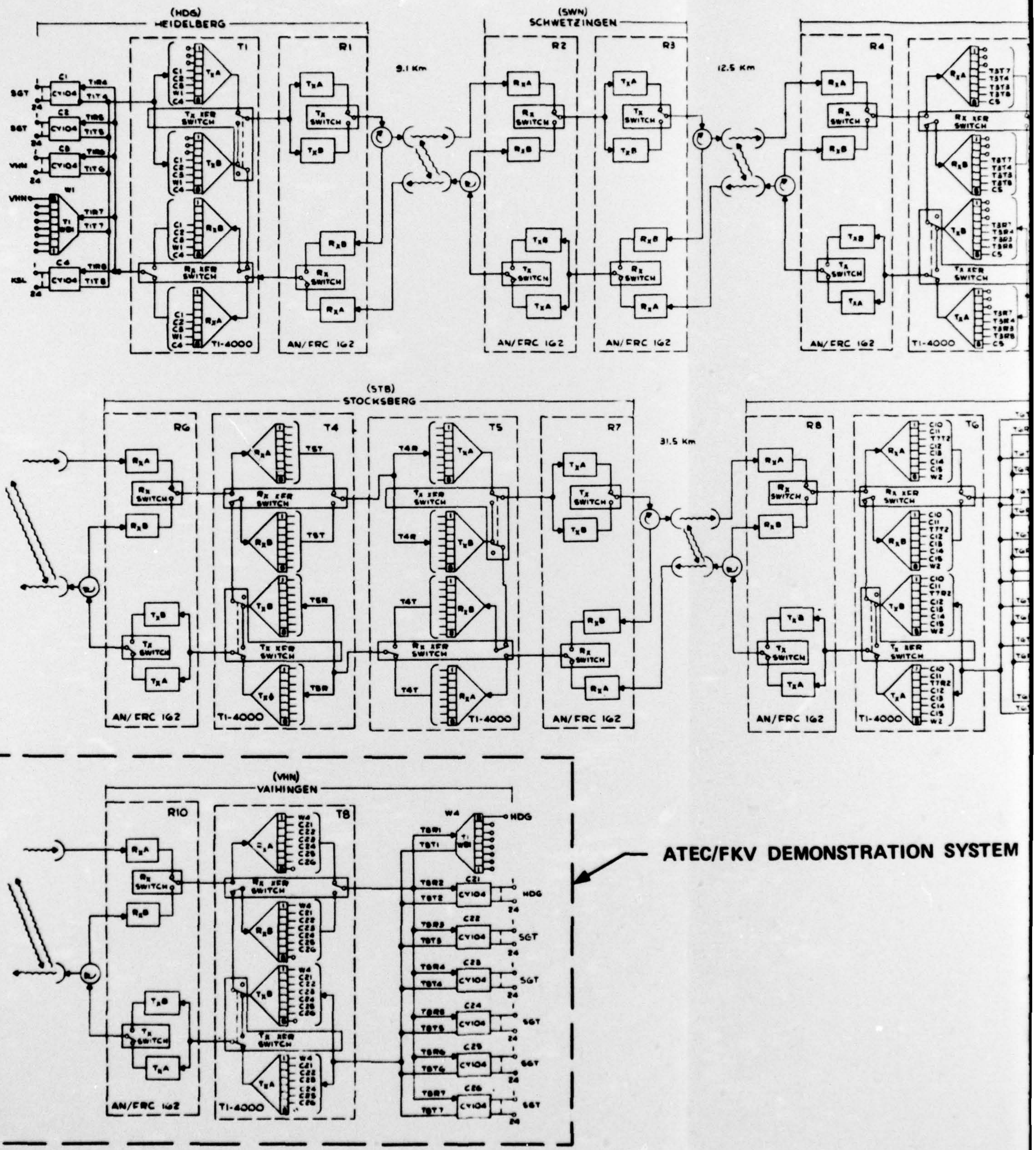
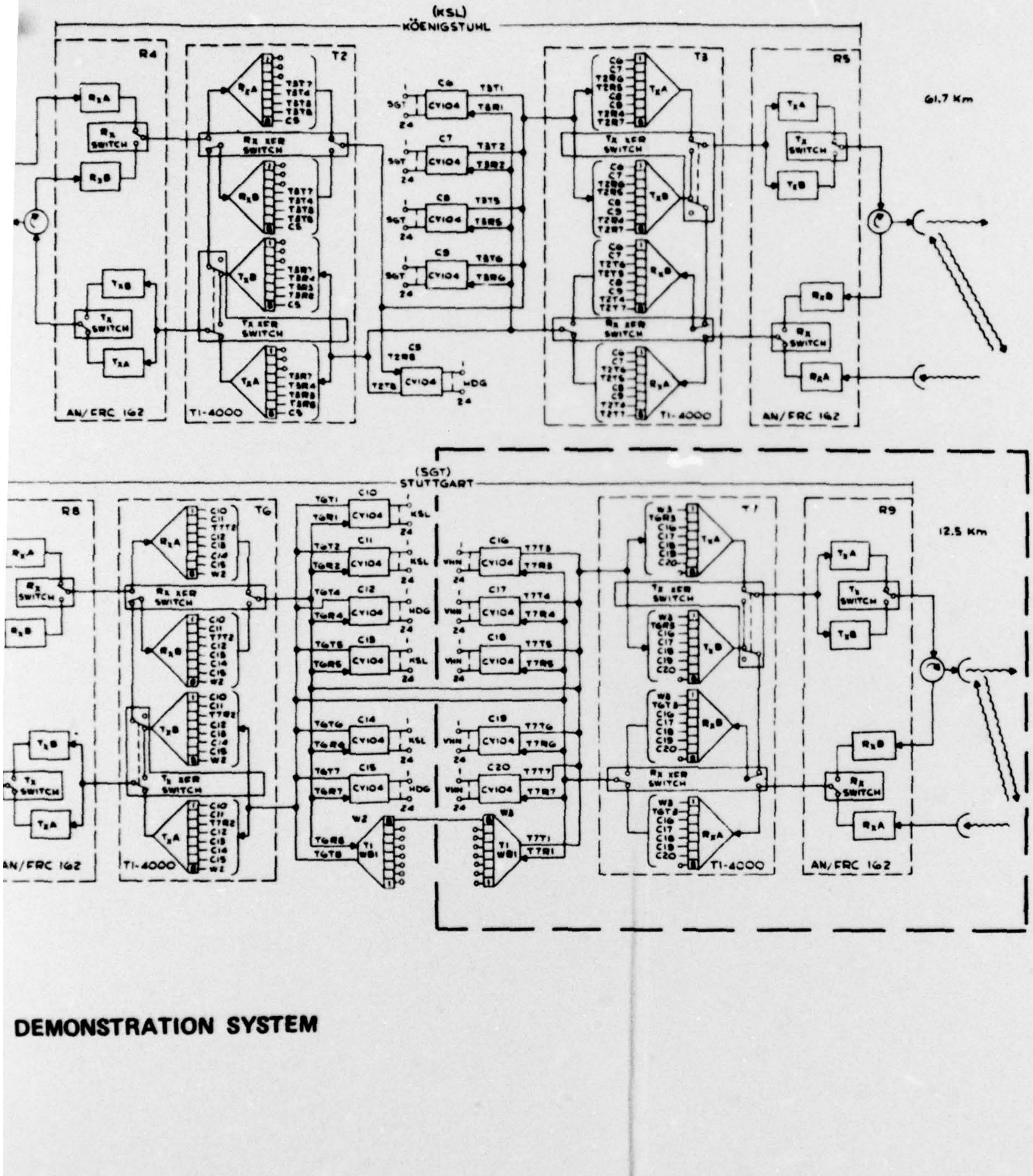


FIGURE 2-7. ALARM/ PARAMETER MONITOR POINT LIST VAIHINGEN

2



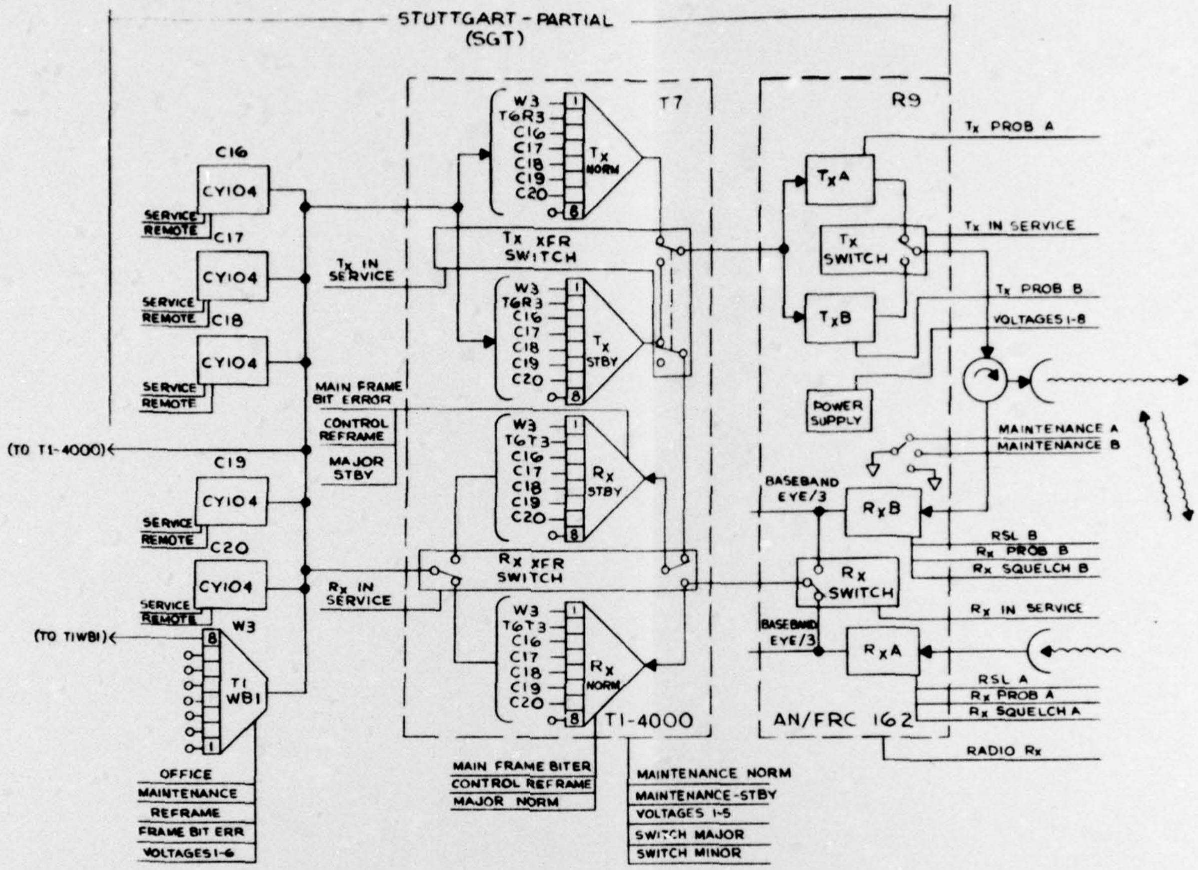
ATEC/FKV DEMONSTRATION SYSTEM



DEMONSTRATION SYSTEM

FIGURE 3-1. FKV DEMONSTRATION SYSTEM DIAGRAM

2



ALARM SCANNER NO.1 (40 ALARMS)

- •SERVICE / C16
- REMOTE / C16
- •SERVICE / C17
- REMOTE / C17
- •SERVICE / C18
- REMOTE / C18
- •SERVICE / C19
- REMOTE / C19
- •SERVICE / C20
- REMOTE / C20
- •OFFICE / W3
- MAINTENACE / W3
- REFRAME / W3
- MAJOR STBY / T7
- MAJOR NORM / T7
- •SWITCH MAJOR / T7
- SWITCH MINOR / T7
- Tx PROB A / R9
- Tx PROB B / R9
- Rx SQUELCH A / R9
- Rx SQUELCH B / R9
- Rx PROB A / R9
- Rx PROB B / R9
- •RADIO Rx / R9
- Tx IN SERV / T7
- Rx IN SERV / T7
- MAINTENANCE - NORM / T7
- MAINTENANCE - STBY / T7
- Tx IN SERV / R9
- Rx IN SERV / R9
- MAINTENANCE A / R9
- MAINTENANCE B / R9
- BATTERY CHARGER
- DC / AC INVERTER
- W. G. PRESSURE
- W. G. HUMIDITY
- A.C. POWER
- BATTERY STATUS
- • SITE
- SPARE

• SUDDEN SERVICE FAILURE SENSING SYSTEM

ANALOG SCANNER NO. 1 (40 PARAMETERS)

- RSL A / R9
- RSL B / R9
- EYE A-1 / R9
- EYE A-2 / R9 } BASEBAND MONITOR
- EYE A-3 / R9
- EYE B-1 / R9
- EYE B-2 / R9 } PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR
- EYE B-3 / R9
- MAIN FRAME BIT ERR NORM / T7
- CONTROL REFRAME NORM / T7
- MAIN FRAME BIT ERR STBY / T7
- Rx IN SERVICE / R9
- Rx SQUELCH A / R9
- Rx SQUELCH B / R9
- Rx IN SERVICE / R7
- CONTROL REFRAME STBY / T7
- REFRAME / W3
- FRAME BIT ERROR / W3
- •VOLTAGE 1 / W3
- •VOLTAGE 2 / W3
- •VOLTAGE 3 / W3
- •VOLTAGE 4 / W3
- •VOLTAGE 5 / W3
- •VOLTAGE 6 / W3
- •VOLTAGE 1 / T7
- •VOLTAGE 2 / T7
- •VOLTAGE 3 / T7
- •VOLTAGE 4 / T7
- •VOLTAGE 5 / T7
- •VOLTAGE 1 / R9
- •VOLTAGE 2 / R9
- •VOLTAGE 3 / R9
- •VOLTAGE 4 / R9
- •VOLTAGE 5 / R9
- •VOLTAGE 6 / R9
- •VOLTAGE 7 / R9
- •VOLTAGE 8 / R9
- SPARE
- SPARE
- SPARE
- SPARE
- SPARE
- SPARE

•OPTIONAL

BUILDING

BATTERY C
DC/AC IN
W.G. PRES
W.G. HUM
A.C. DOW
BATTERY
SITE

BASEBAND
EYE N
EYE A
EYE B

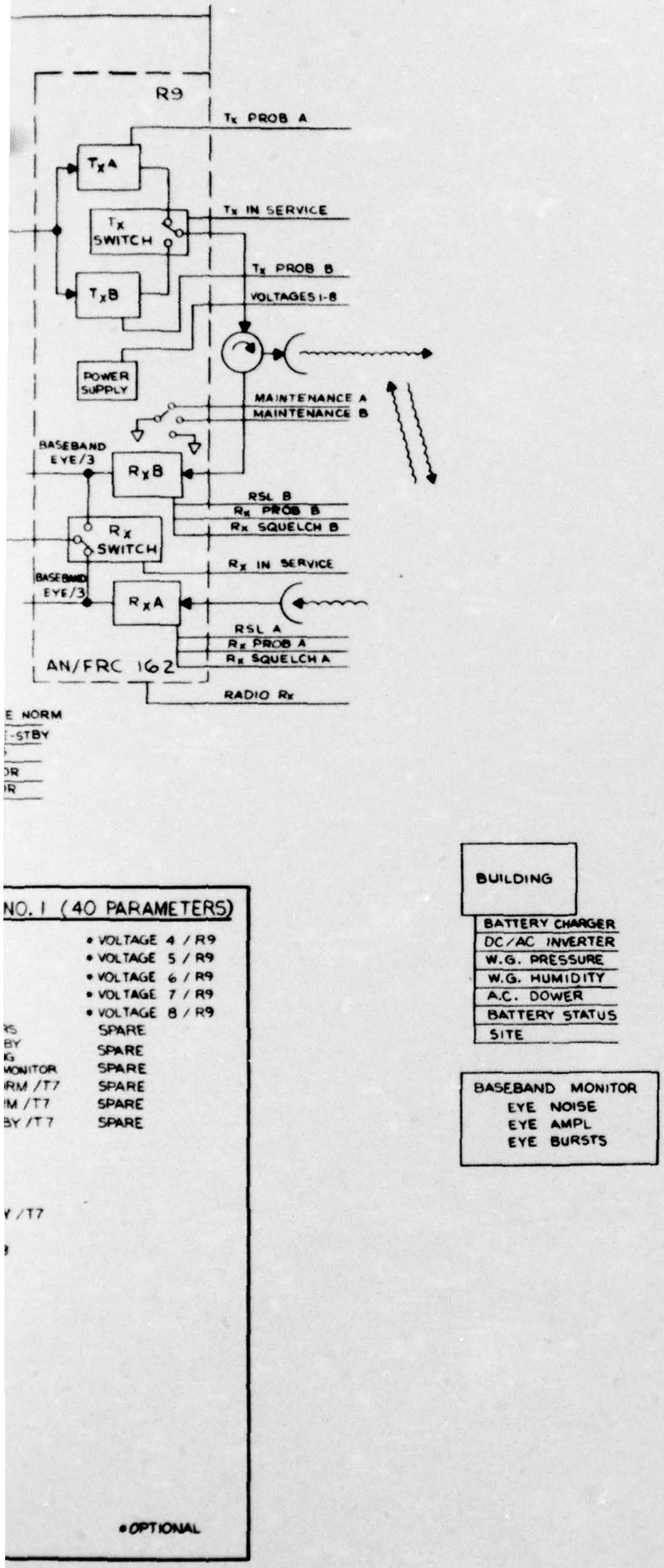
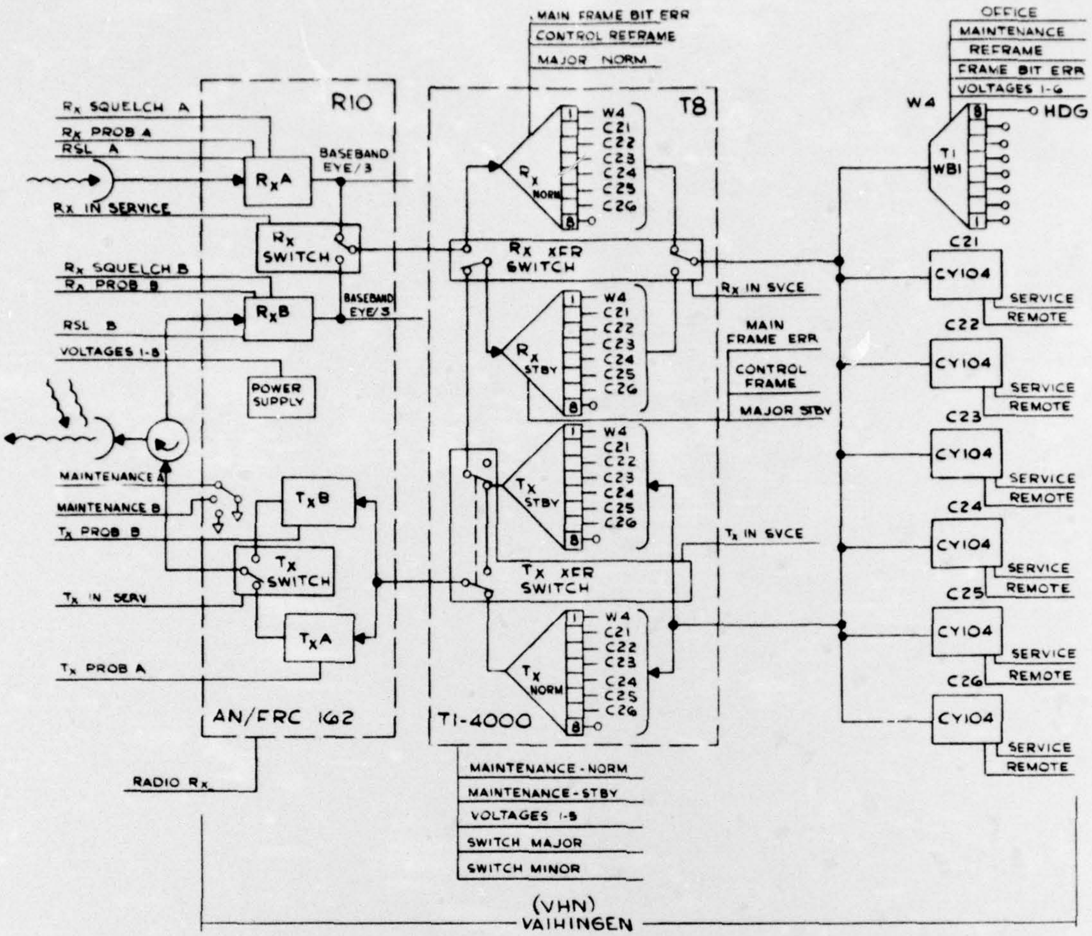


FIGURE 3-2. ALARM/PARAMETER MONITOR POINT LIST - DEMONSTRATION STUTTGART

2



ALARM SCANNER NO. 2 (40 ALARMS)

Rx SQUELCH A/R10
Rx PROBLEM A/R10
Rx SQUELCH B/R10
Rx PROBLEM B/R10
• RADIO Rx/R10
MAINTENANCE A/R10
MAINTENANCE B/R10
Tx PROBLEM A/R10
Tx PROBLEM B/R10
MAJOR NORM/T8
MAJOR STBY/T8
• SWITCH MAJOR/T8
SWITCH MINOR/T8
MAINTENANCE NORM/T8
MAINTENANCE STBY/T8
Rx IN SERVICE/R10
Tx IN SERVICE/R10
Rx IN SERVICE/T8
Tx IN SERVICE/T8
• OFFICE/W4
MAINTENANCE/W4
REFRAME/W4
• SERVICE/C21
REMOTE/C21
• SERVICE/C22
REMOTE/C22
• SERVICE/C23
REMOTE/C23
• SERVICE/C24
REMOTE/C24
• SERVICE/C25
REMOTE/C25
• SERVICE/C26
REMOTE/C26
BATTERY CHARGER
W.G. PRESSURE } OR'D
W.G. HUMIDITY }
TOWER LIGHTS
A.C. POWER
BATTERY STATUS
• SITE

• SUDDEN SERVICE FAILURE SENSING SYSTEM

ANALOG SCANNER NO. 2 (40 PARAMETERS)

RSL A/R10
RSL B/R10
EYE A-1/R10 } BASEBAND MONITOR
EYE A-2/R10
EYE A-3/R10
EYE B-1/R10 } PARAMETERS MEASURED BY MULTIPLEXING BASEBAND MONITOR
EYE B-2/R10
EYE B-3/R10
MAIN FRAME BIT ERR NORM/T8
CONTROL REFRAME NORM/T8
MAIN FRAME BIT ERR STBY/T8
CONTROL REFRAME STBY/T8
Rx IN SERVICE/R10
Rx SQUELCH A/R10
Rx SQUELCH B/R10
Rx IN SERVICE/T8
FRAME BIT ERR/W4
REFRAME/W4
♦ VOLTAGE 1/R10
♦ VOLTAGE 2/R10
♦ VOLTAGE 3/R10
♦ VOLTAGE 4/R10
♦ VOLTAGE 5/R10
♦ VOLTAGE 6/R10
♦ VOLTAGE 7/R10
♦ VOLTAGE 8/R10
♦ VOLTAGE 1/T2
♦ VOLTAGE 2/T2
♦ VOLTAGE 3/T2
♦ VOLTAGE 4/T2
♦ VOLTAGE 5/T2
♦ VOLTAGE 1/W4
♦ VOLTAGE 2/W4
♦ VOLTAGE 3/W4
♦ VOLTAGE 4/W4
♦ VOLTAGE 5/W4
♦ VOLTAGE 6/W4
SPARE
SPARE
SPARE
SPARE
SPARE
SPARE

♦ OPTIONAL

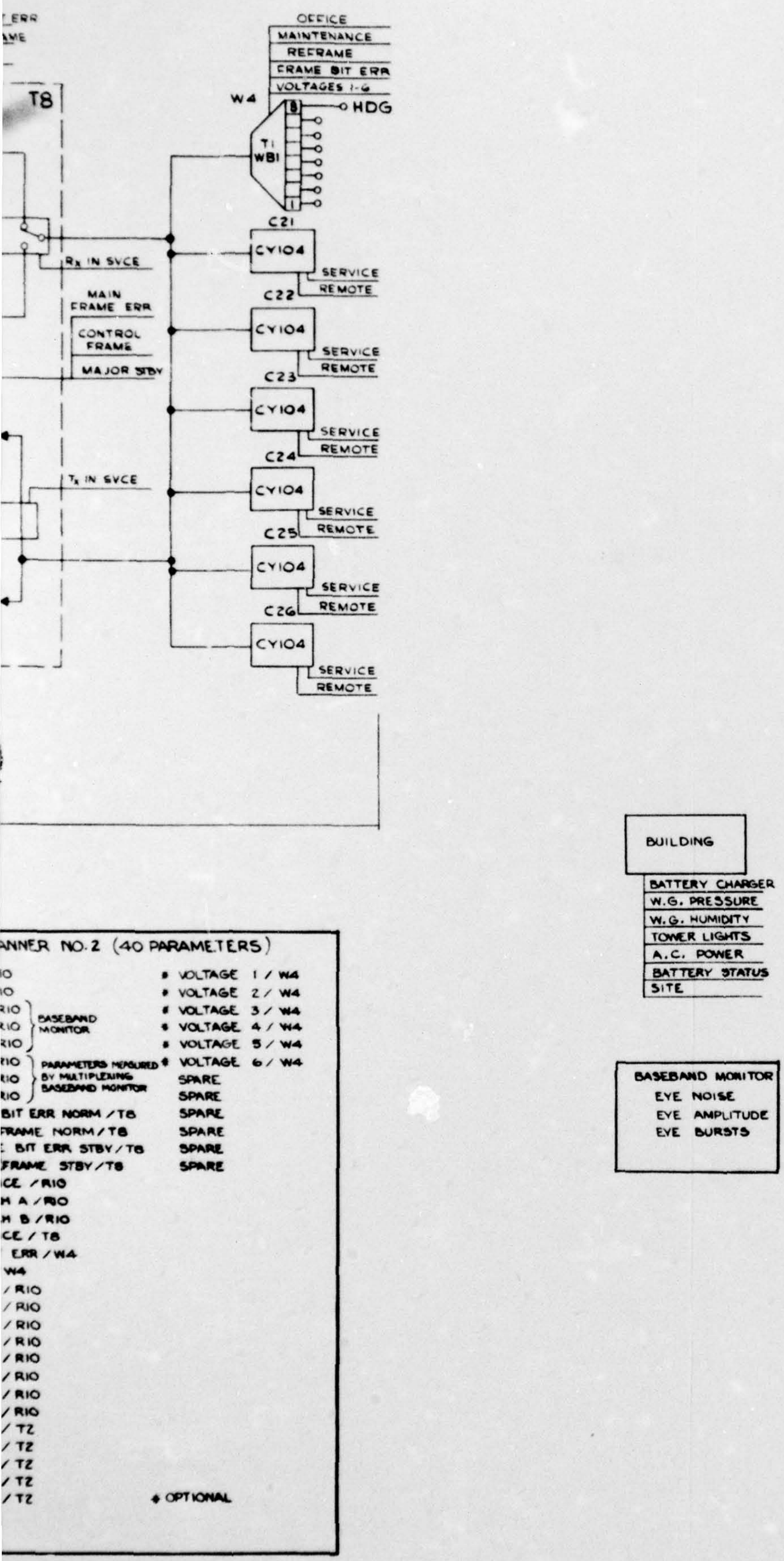
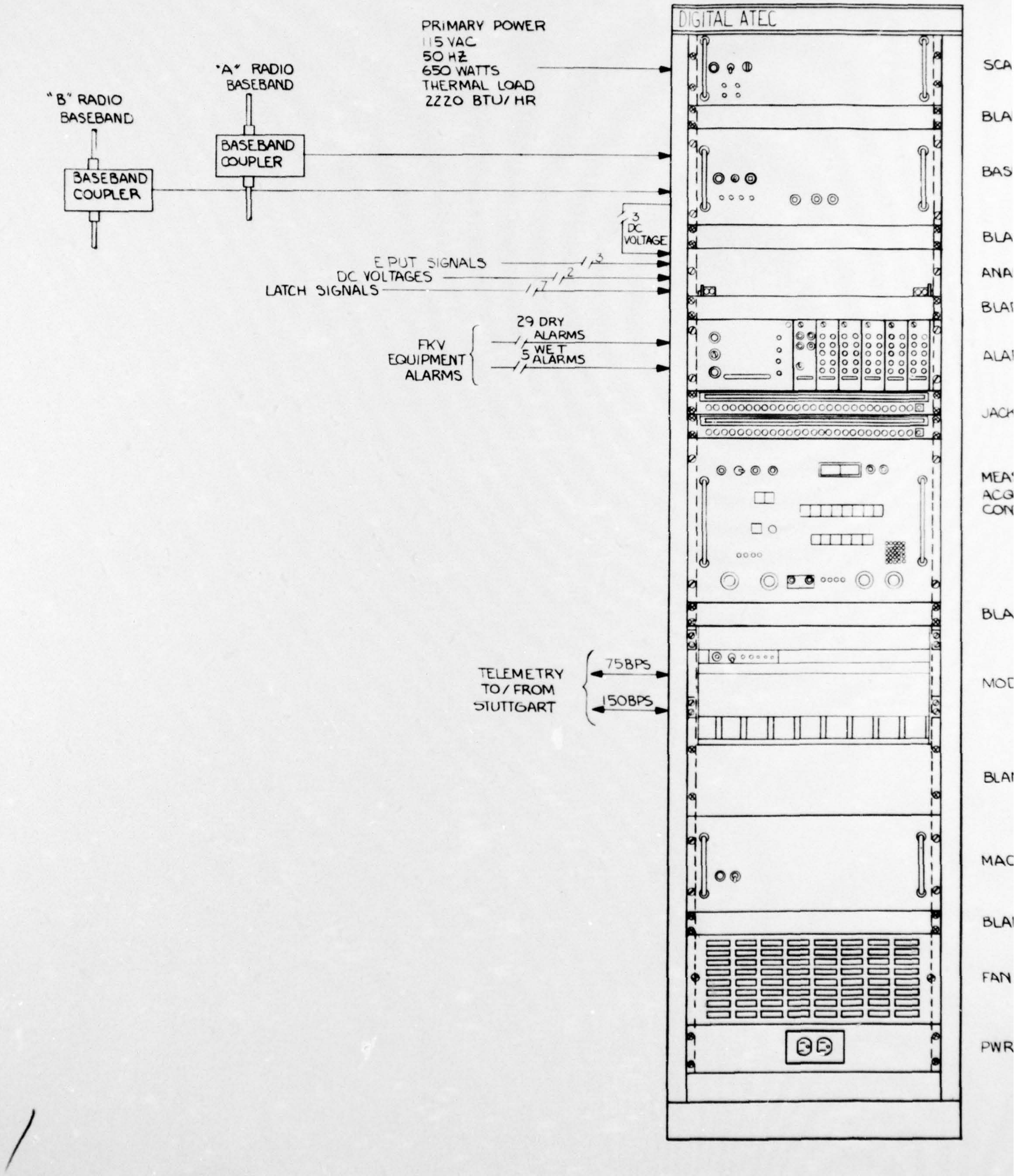


FIGURE 3-3. ALARM/PARAMETER MONITOR POINT LIST - DEMONSTRATION VAIHINGEN


DIGITAL ATEC
PRIMARY POWER
115 VAC
50 HZ
650 WATTS
THERMAL LOAD
2220 BTU/HR
"A" RADIO
BASEBAND
"B" RADIO
BASEBAND
BASEBAND
COUPLER
BASEBAND
COUPLER
3
DC
VOLTAGE
E PUT SIGNALS
3
DC VOLTAGES
2
LATCH SIGNALS
7
FKV
EQUIPMENT
ALARMS
29 DRY
ALARMS
5 WET
ALARMS
TELEMETRY
TO/FROM
STUTTGART
75BPS
150BPS
SCA
BLA
BAS
BLA
ANA
BLA
ALA
JACK
MEA
ACQ
CON
BLA
MOD
BLA
MAC
BLA
FAN
PWR

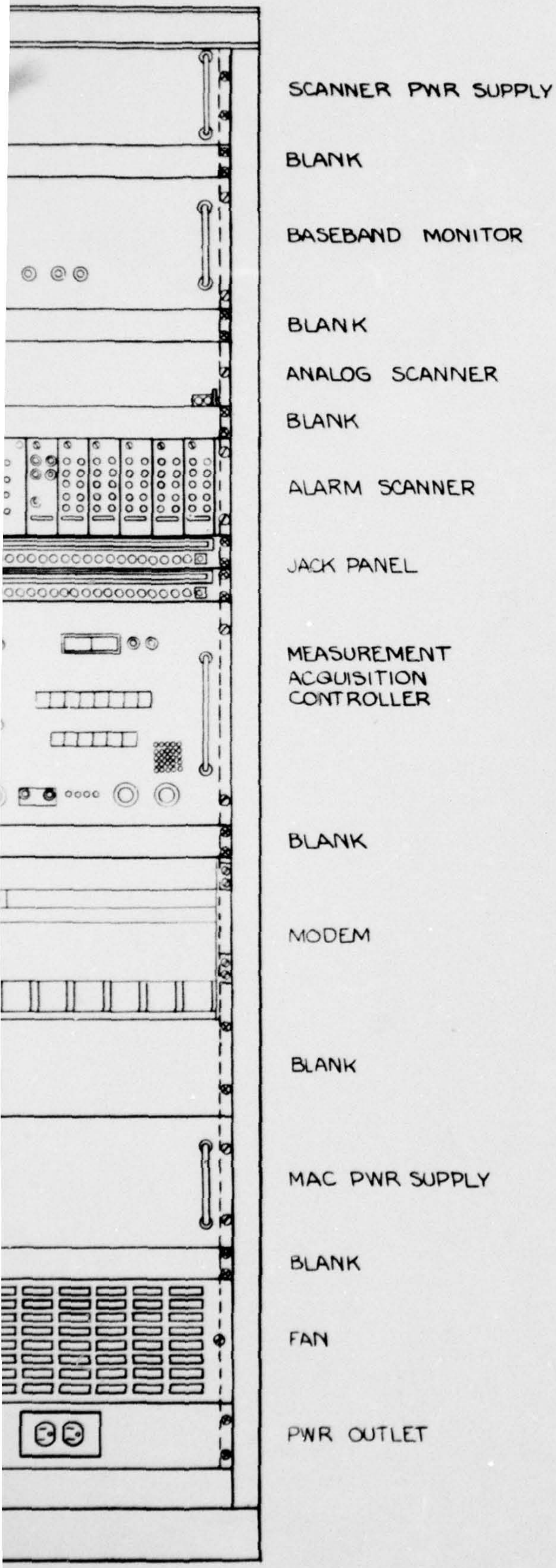
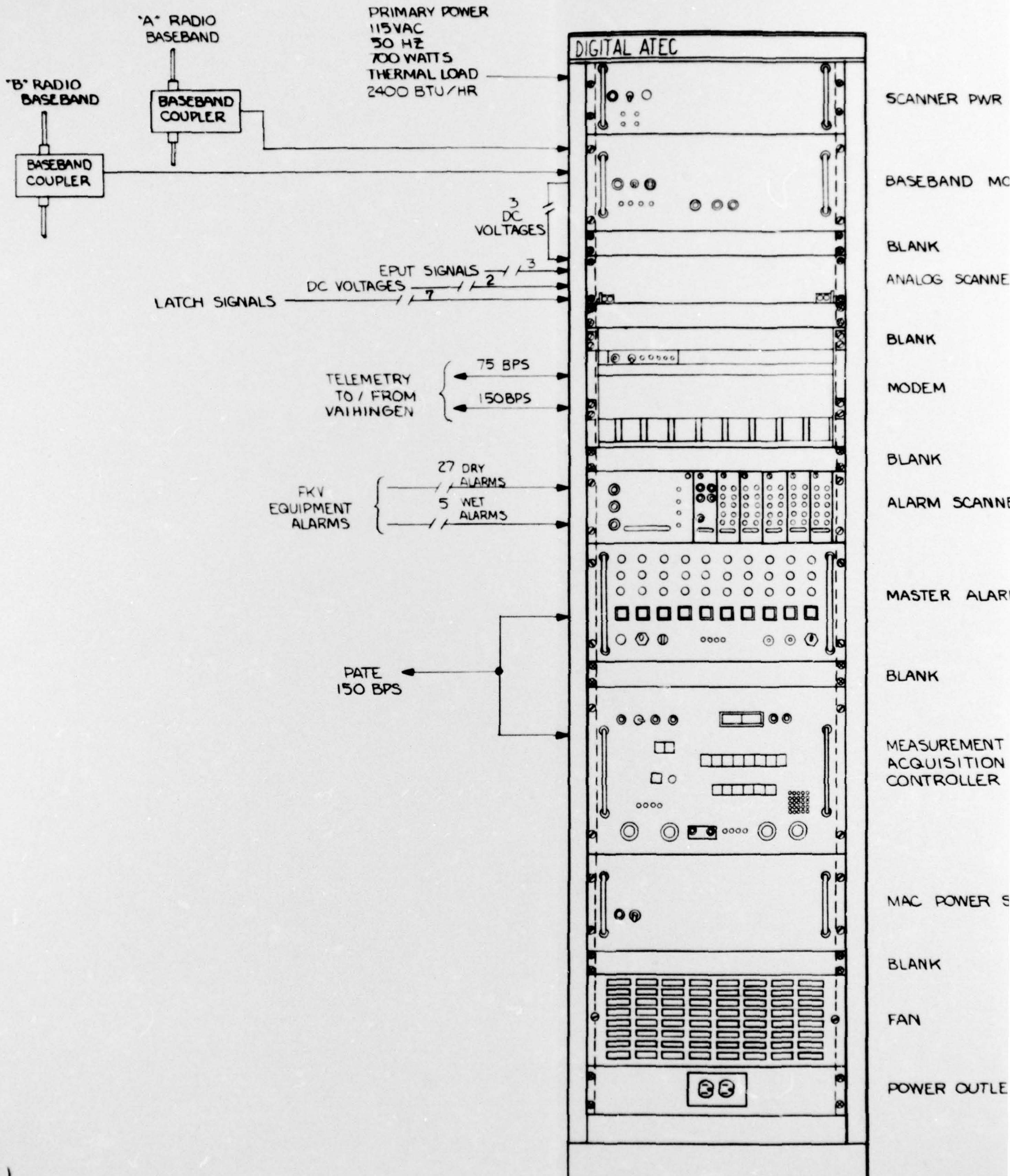


FIGURE 3-5. ILLUSTRATION OF SGT MONITORING EQUIPMENT INTERCONNECTION FOR DEMONSTRATION

2


"A" RADIO BASEBAND
"B" RADIO BASEBAND
BASEBAND COUPLER
BASEBAND COUPLER
PRIMARY POWER
115VAC
50 HZ
700 WATTS
THERMAL LOAD
2400 BTU/HR
DIGITAL ATEC
3 DC VOLTAGES
EPUT SIGNALS 3
DC VOLTAGES 2
LATCH SIGNALS 7
TELEMETRY TO / FROM VAIHINGEN
75 BPS
150BPS
FKV EQUIPMENT ALARMS
27 DRY ALARMS
5 WET ALARMS
PATE 150 BPS
SCANNER PWR
BASEBAND MO
BLANK
ANALOG SCANNE
BLANK
MODEM
BLANK
ALARM SCANNE
MASTER ALAR
BLANK
MEASUREMENT ACQUISITION CONTROLLER
MAC POWER S
BLANK
FAN
POWER OUTLE

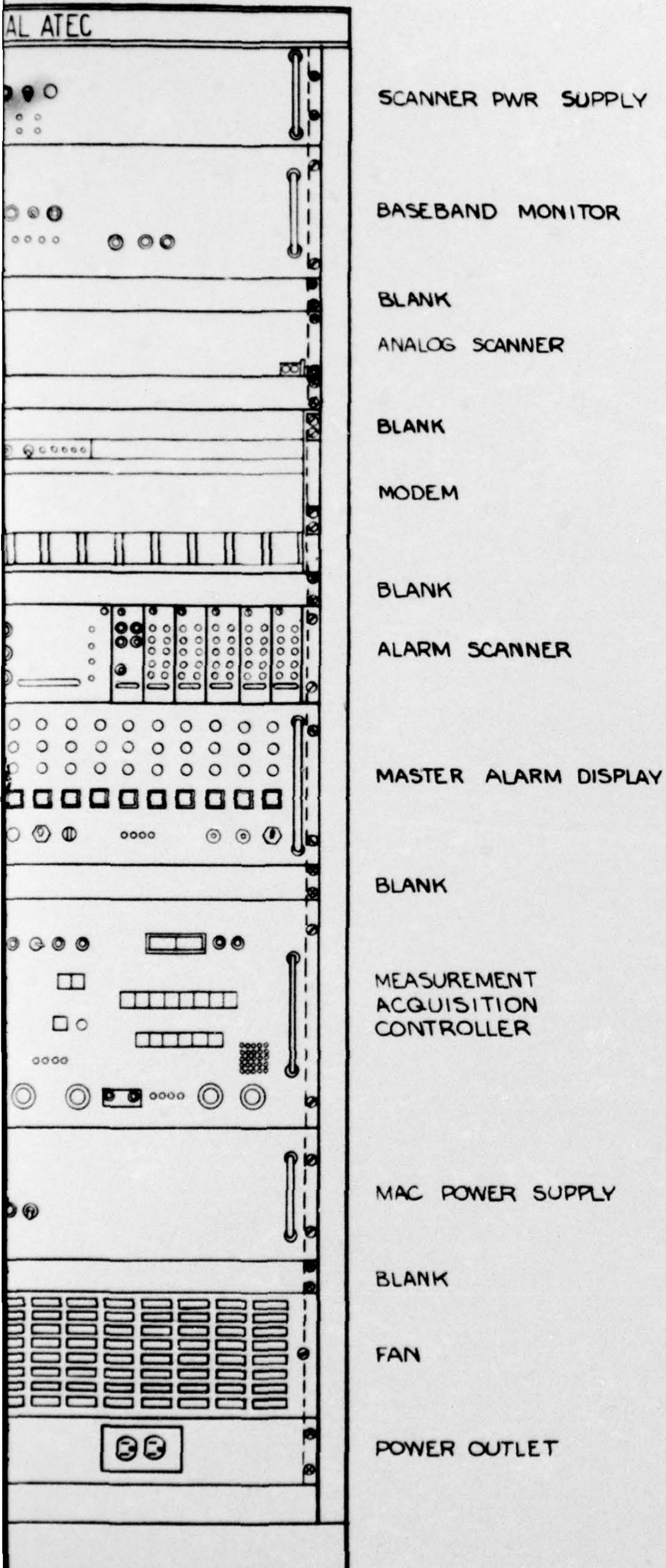


FIGURE 3-6. ILLUSTRATION OF VHN MONITORING EQUIPMENT INTERCONNECTION FOR DEMONSTRATION

2

MISSION
of
Rome Air Development Center

RADC plans and conducts research, exploratory and advanced development programs in command, control, and communications (C^3) activities, and in the C^3 areas of information sciences and intelligence. The principal technical mission areas are communications, electromagnetic guidance and control, surveillance of ground and aerospace objects, intelligence data collection and handling, information system technology, ionospheric propagation, solid state sciences, microwave physics and electronic reliability, maintainability and compatibility.

AMERICAN REVOLUTION BICENTENNIAL 1776-1976